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COKE OVENS AND FUEL POLICY

THE *Economist* recently commented that lack of coke is only the latest of the raw material shortages that have depressed steel output in 1951 and that in 1952 it might become the most critical. The country's blast furnaces could use some 5,000 tons of coke a week more than they are getting. The estimated requirements for 1952 are 11.7 mill. tons. In 1950 coke ovens processed 22.6 mill. tons of coal to produce 15.4 mill. tons of coke. The steel industry produced about 7 mill. tons in its own ovens, but the blast furnaces took 10 mill., so that the steel industry had to purchase about 3 mill. tons from the National Coal Board and other coke oven operators. The N.C.B. sold about 45% of its oven coke to customers outside the steel industry. If steel production increases according to plan the demand for metallurgical coke will reach 12.8 mill. tons for 1953-54. Steelmakers are planning to meet the extra demand by an increase in their own oven plant and little more than maintenance of current supplies is expected from the N.C.B.

Our contemporary then went on to discuss in the usual rather lukewarm fashion the need for co-ordination in the development of coke oven capacity and in the allocation of coals of the various grades and properties to their appropriate purposes. 'It has been suggested that the best coking coals might, indeed, be sold only to carbonising consumers.' Note the words '*suggested . . . . might, indeed.*' And this is accompanied by a recital of well-known facts: 'Reserves of best carbonisation coals are limited: those of West Durham, for instance, are becoming very scarce.' The paragraph in this article referring to the gas industry is mainly devoted to a discussion of the price to be paid by gasworks for purchased coke oven gas. It quotes the declaration of the Gas Council that it may well be that there is no ultimate solution of the problem that does not involve a reconsideration of ownership and management. A solution adumbrated in the voluminous and sumptuous paper 'The Economics of Gas Production,' presented to the Manchester Section of the Institution last month by T. Nicklin and M. Redman, of the North Western Gas Board, is that the gas industry itself should go in for coke ovens in a big way.

From the technical point of view it may also well be that the function of the coke oven in the national fuel economy is to treat coking coals for the production of metallurgical coke, that the comparatively small volume of coal gas (per ton of coal treated) should be supplied to the gas industry, and that the oven should be heated by producer gas made from the smaller, less valuable grades of the coke made, or from some other inferior fuel. It is suggested that the dwindling supplies of coking coal may be augmented by the development of techniques which can produce hard coke from lower grade coals—a direction in which research is understood to have made some progress already.

Messrs. Nicklin and Redman have taken a particular set of data, with which not everyone will agree in all detail, relating to a particular variety of gas-making coal and have worked out with great industry the cost of gas 'out of holder' (a phrase which is not very fully defined) in the case of some 200 hypothetical works, and they have arrived at certain definite conclusions. They have not revealed quite all their data and there is a disquieting air about the presentation of the paper which is best indicated by a sentence in the closing reply to the discussion. 'The object of the paper,' we are told, 'was to show that the best method of providing the most economical gas is by diluting with producer gas.' The turn of the sentence is unfortunate. We hope the meaning is that an effort has been made in a scientific spirit to discover the best means of producing the cheapest gas and to report, *objectively*, the result of the investigation.

Some criticism of the data came out in the discussion. The discussion, while it lasted, was frank and open, but so 'monumental' a work, as the President of the Institu-

tion, Mr. J. H. Dyde, called it, calls for much more time and much more preparation on the part of the participants than was available in a short afternoon meeting. For example, Mr. W. S. Hubbard made the point that in the overall net coal cost of gas it is necessary to take the average price received for the whole of the coke and breeze made rather than the yard price of the best grade. We have often asked (but never found the complete answer to) the question, what is the true cost of coke? The market price is fixed by considerations which have little to do with the cost of handling and screening. Mr. Hubbard doubts whether fuel consumption is appreciably lower in the coke oven battery than in the vertical retort bench even without taking waste heat steam into account. Nor does he agree that regenerators are necessarily more efficient than recuperators. He has come to the conclusion that even these calculations show no significant difference in the cost of making a 500 B.Th.U. gas in the three retorting systems investigated. Other factors must turn the scale —naphthalene troubles, urban amenities. The President of the Institution made the very interesting remark that he had been looking all over the Eastern area for a site for a coke oven plant—it had been difficult enough to find one for intermittent verticals.

INCONCLUSIVE FINDINGS

FURTHER discussion would no doubt have led to the raising of many other points of importance. The chief of these is the coal cost of the gas made, and by this we mean not the cost of the coal but the share of the nation's already insufficient supply of coal which must be allocated to the gas industry to meet its obligations to the public, the growing and pressing demands of its present and would-be consumers. We need not go again here into this vastly important, indeed over-riding, aspect of the choice of plant. Which then of the systems discussed in this paper will produce the maximum of gaseous therms at a reasonable, not necessarily the lowest, price and at a calorific value which can be distributed and applied at a reasonable, not necessarily the lowest possible, cost? We doubt whether gas consumers 15 years hence, if 'gas cuts' should by then prove to be necessary, will be consoled by a plentiful supply of coke, although no doubt they will expect that as well.

After having elicited an answer to that important question, there would be some points of detail to which attention would have been directed in a longer discussion. Mr. A. K. Collinge touched on one of them. Capital charges are not the same for all calorific values if thermal output per retort varies. Presumably the paper assumes no variation here. But that of course is not true. We have more than once called attention to the desirability of undertaking investigations to establish the calorific value at which the vertical retort will give its optimum thermal output with each of the standard gas-making coals. This is a factor which is not at present known.

We doubt too whether anyone will accept the conclusions about the mechanical producer as being a final condemnation. The mechanical producer is being introduced and given a trial in practice to meet certain definite requirements. Perhaps the chief of these is the amelioration of work in the retort house. Labour is just not the same in the mechanical producer and the step grate. Clinkering is one of those dirty, arduous jobs for which it is becoming increasingly difficult to find the men.

It is to be hoped that any student who is directed to the study of the imposing and apparently exhaustive statistics put forward by Messrs. Nicklin and Redman will be warned to note that they relate to one class of coal only and that even for this no complete specification is given. In regard to vertical retorts we suggest that he should be recommended to compare them with the tables of costs of gas production in the 1952 issue of the *Gas Journal Handbook*. Here he will find the warning that frequent changes in the prices of coal, coke, oil, labour, and plant make such statistics only of transitory value. In the present instability of such prices no completely accurate assessment can be made. And even these figures are vitiated by some of the same erroneous assumptions which run through the paper we have before us.

The paper perhaps merits what the President of the Institution said about it. But it must be, almost sorrowfully, admitted that it is just another example of the way in which the several fuel industries—coal, gas, electricity—are all planning and estimating away in blissful disregard of the crying necessity for a national fuel policy. To paraphrase the closing sentences of the article in the *Economist* to which we referred in the opening sentences of this comment, co-ordination of fuel policy is a responsibility of the Minister of Fuel and Power. This responsibility was not very effectively discharged by former Ministers; it may now have passed to a higher authority. As one of the most complex of all fuel administration and development problems, the position of the coke oven—one only of the facets of the coal utilisation problem—together with the coal demands of the gas industry may well require the urgent attention of Lord Leathers.

GAS LIQUOR AS A FERTILISER

ON later pages of this issue we publish an article on a subject which will be of peculiar interest to the gas industry, as we believe it will also be to the agricultural industry. For a great many years the latent possibilities of utilising the nitrogen content of gas liquor have been fully recognised, but no very serious thought has been given to its agricultural application by those responsible for research within the industry. The world shortage of sulphur (influencing the sulphuric acid supply and hence sulphate of ammonia), among other factors, has brought the issue to the forefront and has led to the realisation that in gas liquor as such the industry has a potentially valuable source of nitrogenous fertiliser and one which may well prove cheaper and more effective than sulphate of ammonia, though we would not go so far as to say it will replace it.

While trials have been progressing in several areas,

our article deals in the main with those in Hampshire, where the Southern Gas Board, in collaboration with the agricultural advisory staff, has pioneered some comprehensive experiments, many of which have achieved most encouraging results. It is emphasised, however, that the whole matter is still in its infancy, and the article must be regarded in the light of a preliminary report. Probably many years of intensive trial by both industries will elapse before any degree of finality is reached; but in the meantime it may be said that the subject has definitely been 'put on the map' and has stimulated considerable interest in 'official circles.' So much so, in fact, that the Ministry of Agriculture has secured specially from Denmark a liquid manure drill for the purpose of furthering the Hampshire experiments this coming season.

Our article may be regarded as a 'first in the field' report on this subject, and while it is appreciated that we have no more than touched the fringe we hope to have stimulated in the gas industry a wider interest in what may well prove to be an outstanding development in the use of a gasworks product. What is needed now is for gas boards which have not hitherto taken any part in this work to offer their services to the agricultural interests with the object of breaking down farmers' prejudices against a 'new-fangled' fertiliser and of widening the scale of experiments so as to embrace all the varying soil and weather conditions of these islands. Only by full co-operation in every area shall we get reliable results in the shortest time.

GAS FIRE GUARDS

In our editorial comments on the desirability of improved guards for gas fires, published in the *Journal* two issues ago, reference was made to an article by Dr. Leonard Colebrook which appeared in *The Times* of January 7. The article brought forth replies from both the gas and solid fuel industries. The latter, from the Director-General of the Coal Utilisation Joint Council, points out that Dr. Colebrook's statement that the open coal fire is still 'the outstanding hazard of the English home' is true only if it means that, because of the large number of coal fires in this country and the much greater frequency of their use than either gas or electric fires, the total number of burning accidents due to coal fires will be large. The letter goes on to emphasise that in comparison with the number of coal fires in use, the number of burning accidents is comparatively low, and concludes 'More must be done to encourage the use of fire guards with every kind of fire that constitutes a burning hazard.' A similar determination is expressed in the letter from the Secretary of the Gas Council who asserts that '. . . the industry is fully alive to the importance of this matter.' The letter maintains that for many years the gas industry has endeavoured to draw attention to the advisability of guards and that inexpensive dress guards have been on sale in showrooms. This may perhaps be news to some people in the industry, as will the statement that 'Where fires have been displayed at exhibitions, it has been the practice to have guards fitted to them.' Our comment on this is that there are guards and guards. Now that improved guards are becoming available they should be brought to the attention of consumers in every way possible.

ELECTRICITY CHARGES

Between 300 and 400 different tariffs under which electricity consumers in the North Western area formerly bought their electricity have been superseded by a single new system of charge based on the number of assessable rooms in a household of five rooms and over. For the first five rooms a consumer must now buy 36 units per quarter at 5d. a unit (or 6d. for prepayment users) before enjoying a standard charge of $\frac{7}{8}$d. per unit. For each additional assessable room up to a maximum of 12 rooms a further 12 units will be charged at 5d. (or 6d.). Fixed charges are abolished, as consumers will start each quarter on a 36-unit block. The change affects about 1,150,000 domestic consumers, and the 'average maximum disturbance' of domestic charges in the area have been estimated at about 1¼d. per week. Broadly speaking, about a third of the consumers will pay the same rates as before, a third will have to meet a small increase, and a third will enjoy a small decrease. The system is in keeping with the policy of the British Electricity Authority for simplifying tariffs and it will be a convenience to the North Western Board when it has to revise prices to keep pace with rises in the cost of coal. The new charges were assessed on an analysis of replies to circulars sent to the public 12 months ago, and the North Western Electricity Consultative Council is satisfied that the system is one that causes the least variation in charges in the area as a whole.

NEW TOWN DEVELOPMENTS

Six of the 12 area boards are concerned with the supply of gas to the 12 new towns now being developed under the New Towns Act, 1946, in which, according to statistics just issued by the Ministry of Housing and Local Government, 3,126 houses had been completed by the end of 1951 and 5,056 were under construction. In the *Journal* of May 2, 1951, we described what was being done by the South Eastern Gas Board for Crawley, then the most advanced of the new towns, and on October 24 we outlined the gas distribution system adopted by the North Thames Gas Board for the new town at Basildon, Essex. The brunt of the new town problem falls on the Eastern Gas Board, which has five of the new towns within its area, including Hemel Hempstead, which heads the latest statistics with 816 houses completed, of which 250 are occupied by local industrial workers and 200 by the builders. One factory is now operating, and with the six others being built there will be employment for 4,500 people, about half the new town's planned capacity. Already the Eastern Board has spent over £115,000 on trunk and estate mains to the five new towns, and it is estimated that during the development of a new town the cost of interest and depreciation will vary from 7.57d. to 4.24d. per therm.

The Northern Gas Board recently reported that main-laying work at a cost exceeding £20,000 had been authorised for Newton Aycliffe, and that work was well advanced on a £127,500 scheme for a 12 in. main, with ancillaries, from Hartlepool to the new town at Peterlee. Although house building has not yet got under way at Corby, the East Midlands Gas Board has approved a £20,900 main-laying scheme to convey gas to the new town. Close contact is reported between the Wales Gas Board and the Cwm Bran Development Corporation on the supply of gas to a population ultimately numbering 35,000. Meanwhile, a provisional scheme has been prepared for the supply of gas to a new residential town in Glamorgan which is expected to house 20,000 people. Mains to new towns have to be laid well in advance of occupation, and

a long time, measured often in years, must elapse before anything like a remunerative return can be obtained for the capital spent. All the area boards concerned are confronted with a serious financial problem. An interest-free loan or a contribution under Section 11 of the New Towns Act would ease their burdens considerably.

A TESTING YEAR

SIR ARCHIBALD FORBES, President of the Federation of British Industries, addressing the annual meeting of F.B.I. members in Scotland on January 11 described 1952 as an exceptionally testing year for the country and for industry. On the general need for rationing and allocation schemes in the present economic situation he said it was to be hoped that such measures would be kept to the irreducible minimum as they could operate only to curtail the flexibility and initiative inherent to the successful conduct of industry. As to the possibility of cuts in domestic capital investment he said that however attractive such first-aid or stop-gap measures might appear, the longer term effect would be extremely serious. The ultimate prosperity of the country must rest on increasing total output and maintaining the competitive ability of industry. The combination of inflation and heavy taxation had brought about a situation where there was reason to believe that retained profits might be inadequate for the financing of replacement of fixed assets and the swollen requirements of working capital.

Sir Archibald declared that the use of taxation as a means of draining away the inflationary gap had reached a point where there was a real danger of bringing into operation the law of diminishing returns, and he referred to a threat of the imposition of a further tax—'some form of excess profits tax.' If it took the traditional shape of comparing the results of one year with those of a previous standard period and the imposing of a duty on the excess it would be open to the well-known objections of being destructive to enterprise and productive of inefficiency. A further objection to such a tax arose from the marked increase of inflation since the war and its varying incidence on different industries and individual units. There would be a danger of taxing a purely inflationary increase in profit as conventionally measured when in fact there might be no comparable increase in true profit when regard was had to the necessity to maintain capital intact under inflationary conditions. In conclusion he made a double appeal to industrialists. First, to show clearly in their accounts the provisions required to maintain intact the physical, as distinct from the money, capital, leaving only as net profit the amount which was truly free for appropriation; and secondly, to explain the accounts, the function of profit, and its indispensability to the continuity of the business to the staff and workpeople, who were more likely to be convinced by their own management than by treatises from remote organisations.

Personal

Mr. Hugh Beck, Manager of the London office of Crossley Bros., Ltd., has been appointed to a seat on the Board.

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Sir Alexander Aikman, Chairman of Powers-Samas Accounting Machines, Ltd., since 1945, has resigned from the Board. He is succeeded by **Colonel A. T. Maxwell,** a director of Vickers, Ltd.

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Mr. A. J. Wells has been appointed Deputy Industrial Relations Officer on the headquarters staff of the East Midlands Gas Board. Mr. Wells is a Corporate Member of the Institute of Personnel Management and has recently returned from India where he was Senior Personnel Officer to the group of companies controlled by Parry and Co., Ltd., Managing Agents. In India, Mr. Wells was a member of the Madras Chamber of Commerce and the Employers' Federation of Southern India, from which he was nominated a delegate to the Employers' Federation of India.

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Mr. L. E. Saker, who has over 40 years' experience with Lancashire Dynamo and Crypto (Mfg.), Ltd., has been appointed Chief Engineer of the Willesden works of that company. Mr. Saker is Chairman of the Design Committee at Willesden and was for many years Chief A.C. Designer. He will be responsible for the design and performance of the complete range of products manufactured at the Willesden works—a function which he has, in effect, been carrying out over the past few years.

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Mr. Charles R. Saunders, 50 year old North Thames Gas Board motor mechanic, has been presented with a Royal Humane Society's Certificate in recognition of his bravery in saving a man from drowning in the River Thames last summer. Mr. Saunders was fishing at the time, on the tow-path at St. Margaret's, Twickenham, and dived in the river to pull the man ashore. At the presentation ceremony at the Board's motor repair shop at Brentford, representatives of the Metropolitan Police, Chief Supt. S. Hougham, M.B.E., and Inspector Day, of Twickenham, attended, together with Police Constable G. T. Jones, who received a similar award for his assistance in the rescue.

Diary

Jan. 26.—Yorkshire Juniors: 'Bower Barffing and Vitreous Enamelling,' H. Whittaker (Rustless Iron Co., Ltd.). At Wakefield.

Jan. 28.—Scottish Juniors (Western District): Evening visit to Kemsley House, Glasgow.

Jan. 29.—London and Counties Coke Sales Circle: 'Trial by Jury' of a Producer Member and a Distributor Member. Holborn Restaurant. 2.15 p.m.

Jan. 31.—North Thames G.C.C.: Caxton Hall, Westminster, 2.30 p.m.

Feb. 1.—London and Southern Juniors: Development of a Temperature Limit and Over-heat Control'. N. D. B. Harris (North Thames); 'The Gas Engineer and I', Mrs. Eileen Murphy (Gas Council); 'Notes on an Installation of Economic Boilers', G. J. B. Cox (South Eastern). 178, Edgware Road, 6.30 p.m.

Feb. 5.—South Eastern G.C.C.: Brettenham House, Waterloo Place, 2.15 p.m.

Feb. 5.—Midland Juniors: 'Coke and Its Appliances from the Domestic Angle', H. A. Barron (Birmingham).

Feb. 7.—Chemical Engineering Group (S.C.I.): Joint Meeting with Nottingham Section, S.C.I.: 'Extraction and Utilisation of Methane from Coal Measures,' Dr. D. W. Gillings.

Feb. 8.—Scottish Juniors (Western): Paper by R. A. Currie (Glasgow). Royal Technical College, Glasgow

Feb. 8.—Midland Section, I.G.E.: Discussion on Report of the Sub-Committee on Unaccounted-for Gas (I.G.E. Comm. 380), to be opened by H. J. Escreet, Chairman of Sub-Committee. Grand Hotel, Birmingham, 2.30 p.m.

Feb. 9.—Scottish Juniors (Eastern): Short paper meeting. Edinburgh.

Feb. 9.—Western Juniors: Visit to Exmouth works; 'Psychology and Plant Operation,' H. C. Widlake (Plymouth).

Feb. 13—London and Southern Juniors: Evening visits: (a) Nevill's Bakeries, Acton; (b) Kemsley Newspapers, Ltd., Kemsley House, W.C.1.

News in Brief

Bentley (Yorks.) Urban District Council has carried out a survey among the tenants of its post-war council houses, which reveals that 75% of the mining families prefer gas cookers to coal fired ranges in their homes, despite their free issue of coal.

At the Invitation of the North Eastern Gas Board, a series of sales and technical talks were given on January 8, 9 and 10, to personnel of the Hull group, by Mr. M. H. Thornton, Water Heater Sales Manager of Radiation Group Sales Ltd., and Mr. H. W. P. Shewring, Radiation Technical Service Department. The talks were well attended and interesting discussions followed.

Weston Lighting.—Mr. O. Pincock, Distribution Engineer of the Weston-super-Mare sub-division of the South Western Gas Board, told the Road Safety Committee at Bristol on January 17 that all lamps in Weston's main roads were inspected each night within an hour of being lit and lamps in side streets were checked every other night. Councillor H. J. Holcombe, presiding, thanked Mr. Pincock, and said that £6,650 was spent on street lighting and illuminations and except for money considerations they would like to improve it and make it the best in the country.

Gas Produced during the past year at the North Thames Gas Board's Beckton works was an all-time record, exceeding the previous best production figures by more than 12%. The total output was 27.288 mill. cu.ft.

Illuminating Engineering Society.—The summer meeting will be held at Eastbourne from May 20 to 23, and the provisional programme invites those who intend to be present to notify the Secretary at 32, Victoria Street, London, S.W.1, not later than February 15. Opening with a civic reception at the Winter Garden on May 20 the meeting will comprise two sessions each day from May 21 to 23, one paper to be presented at each session. The social programme includes a visit to the Glyndebourne Opera House, the President's reception and dinner at the Grand Hotel, and a ladies' visit to Battle Abbey. The programme will also include play for the Dow golf cup.

Change of Title.—The Council of the Scottish Association of Gas Managers after considering a draft of its new constitution, has decided that the official title of the Association should include 'Incorporating the Waverley Association of Gas Managers and the North British Association of Gas Managers. It rejected a proposal that the spring meeting should be called the 'Waverley Meeting' and the autumn meeting the 'North British Meeting.'

More than 120 Apprentices, parents, and senior staff attended the fourth annual supper and social evening of the College and Technical Apprentice Association of the Trafford Park works of Lancashire Dynamo and Crypto (Mfg.), Ltd. The toast of the guests was proposed by Mr. B. Adler (College Apprentice) and that of the Company by Mr. J. Marren (Student Apprentice); the reply being made by Mr. A. W. A. Dick-Cleland, B.SC., M.I.E.E., Joint Managing Director of L.D.C. Guest apprentices from the Willesden works of L.D.C. and from three associated companies—Foster Transformers and Switchgear, Ltd., Nevelin Electric Co., Ltd., and British Electronic Products, Ltd., brought greetings from their respective works apprentice groups.

Leeds Gas Lectures

LEEDS University Department of Coal Gas and Fuel Industries, in association with the Department of Adult Education and Extra-Mural Studies, announces a course of 16 lectures in four sections during the second term of the present session. Mr. F. S. Charnley, Deputy Chief Engineer, North Eastern Gas Board, will give six lectures on carbonisation (on January 21 and 28 and February 4 at 2 p.m. and 3.30 p.m.), dealing with the balance between coal gas, water gas, and peak load gas; choice of calorific value; refractories; carbonisation in continuous vertical retorts; carbonisation in horizontal retorts; coal and coke handling, coke screening, and general works layout.

Dr. F. J. Dent, Director of Research, West Midlands Gas Board, will give two lectures on water gas (on February 11 at 2 p.m. and 3.30 p.m.) and will touch on recent developments in complete gasification.

Mr. J. J. Priestley, of W. C. Holmes & Co., Ltd., will give six lectures (on February 18 and 25 and March 3 at 2 p.m. and 3.30 p.m.) on gas purification, covering the nature of impurities in crude coal gas; types of condensers and exhausters; recovery of ammonia; removal of hydrocyanic acid; removal of hydrogen sulphide, and benzole recovery.

Dr. R. S. Edwards, Chairman of the North Eastern Gas Board, will give two lectures (on March 10 at 2 p.m. and 3.30 p.m.) on the economics of the gas industry, with special reference to production, distribution, and service costs; by-products and their influence on revenue; gas price in relation to sales; capital requirements and depreciation charges; and the financial structure of the industry.

INSTRUMENTS AND PRODUCTIVITY

THE eighth annual luncheon of the British Industrial Measuring and Control Apparatus Manufacturers' Association was held at Brown's Hotel, London, on January 15. The Association includes companies manufacturing over 90% of the industrial instruments which are of importance in the country's efforts to increase productivity.

Sir Norman Kipping, J.P., Director-General of the Federation of British Industries, said that by increasing productivity, British industry can close the door to the infiltration of the Communist cold war into our national life. He also referred to the news that America was going to assist us very materially to meet our essential requirements for steel, and remarked on the great change in attitude in the United States towards our needs for raw materials. This he contrasted with the fact that since the war we had exported coal to the value of £100 mill. less than in a comparable pre-war period, and that three-quarters of all Marshall Aid to Europe was made necessary by lack of coal.

Mr. L. S. Yoxall, Chairman of the Association, recalled the early motor car, with its complete lack of those aids and gadgets which are considered essential today. The same applied to the progress of the instrument industry in relation to British industry generally.

Mr. W. G. Ardley, President of the Association, was in the chair and proposed the toast of the guests, mentioning that Lieut.-General Sir Kenneth Crawford, K.C.B., M.C., Controller of Supplies (Munitions) at the Ministry of Supply, who replied for the guests, was a qualified parachutist, 'the hall-mark of concentrated resolution.'

Sir Kenneth referred to the great part played by the industrial instrument industry in increasing productivity in the defence and vital national industries and in making possible great fuel economies, as well as directly exporting 30% of its output on its own account. The importance of the instrument industry would be reflected in the steel allocation that the Ministry of Supply hoped to make to it.

Boiler House Practice

BOILER house operatives, charge-engineers, and others desiring to take boiler house practice courses, but who are unable for various reasons to attend classes, may now prepare for examinations by home study courses.

The College of Fuel Technology has extended its training facilities to include correspondence courses for the Intermediate and Final Grade Examinations in Boiler House Practice of the City and Guilds of London Institute. These are being arranged with the approval of the Education Committee of the Ministry of Fuel and Power and with the collaboration of makers of combustion equipment. They include sufficient revisionary and supplementary work in physics and chemistry to enable those taking the courses to obtain a sound knowledge of up-to-date boiler house practice.

Full details of these courses can be obtained on application to: The College of Fuel Technology, 90, Talbot Road, Highgate, London, N.6.

MECHANICAL HANDLING EXHIBITION

PRELIMINARY details are now available of the third Mechanical Handling Exhibition and Convention to be held at Olympia, London, from June 4 to 14. Exhibits of about 170 firms, occupying 250,000 sq. ft., will include conveyors, elevators, hoists, stackers, cranes, mechanical loaders and shovels, fork lift trucks, industrial trucks, coal handling plants, overhead runways, aerial ropeways, grain handling plants, wagon tipplers, and ancillary equipment.

Outstanding exhibits will include new giant fork lift trucks, with a lifting capacity of five tons, shown for the first time in Great Britain; a pneumatic grain-handling plant in operation; an automatic crate-packing machine on an entirely new principle; two full-sized wagon tipplers; and a fork truck on giant pneumatic tyres. One of the largest manufacturers in Great Britain will be showing their new industrial tractor with attachments for handling different classes of goods and materials.

Subjects of papers to be read at the convention include motion study and mechanical handling; production engineer and mechanical handling (sponsored by the Institution of Production Engineers); case histories of mechanical handling (discussion by the mechanical aids team which went to the United States who will deal with the results they issued and which were considered at the 1950 Exhibition); versatility of industrial trucks (sponsored by the Industrial Truck Manufacturers' Association); foundry mechanisation; telphers and runways; mechanical aids for smaller units (sponsored by the Mechanical Handling Engineers' Association); and installation and maintenance aspects of electric overhead travelling cranes (sponsored by the Association of Crane Makers).

Two independent consulting engineers, experienced in mechanical handling, are to be available at the overseas reception bureau to give free advice. In commending the exhibition and convention to industrialists at home and abroad, the President of the Board of Trade, Mr. Peter Thorneycroft, M.P., mentions the active support of the trade associations concerned in the manufacture of cranes, ropeways, trucks, and foundry equipment, as well as the Mechanical Handling Engineers' Association. 'I am confident', he writes to the organisers, 'that a great number of our friends abroad will take this opportunity to come and see, under the vast roof of Olympia, the latest developments in mechanical devices expertly designed to increase output, reduce fatigue, improve production methods, and cut overhead costs.'

Sutton Cookery Classes

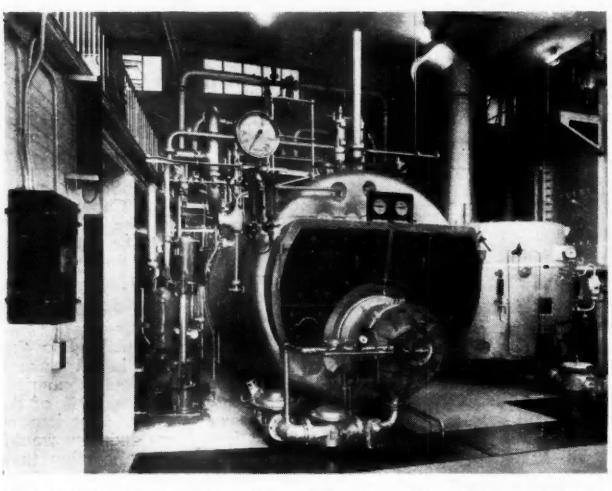
THE home service staff of the West Surrey Division, South Eastern Gas Board, gave cookery instruction to over 200 students, including five men, at the Sutton showroom, during November and December. Five afternoon and five evening classes were held weekly for a period of six weeks and attendances were well maintained throughout. At the end a shortbread baking competition was held.

Mr. F. A. Cheeseman, Divisional Sales and Service Manager, presided at the prize giving ceremony. He was accompanied by the Board's Commercial Manager, Mr. V. W. Stanton, and Chief Home Service Adviser, Mrs. Mair Jones.

The Deputy Mayor of Sutton and Cheam, Councillor Miss Dorothy Webster, presented the prizes. Miss P. Chamont, Head Demonstrator of the Institute of Good Housekeeping, judged the entries.

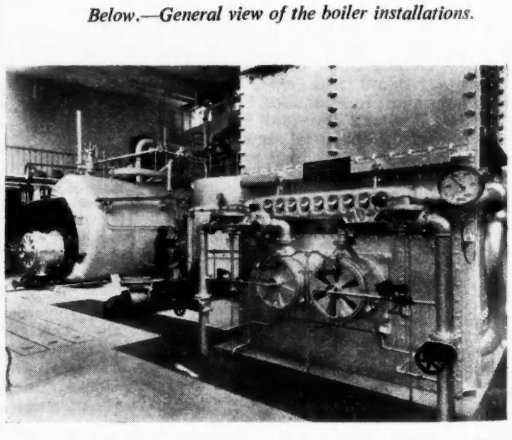
A Further Revision in gas charges is to be made by the Northern Gas Board. Details of the alterations have been drawn up and will shortly be submitted to the Gas Consultative Council. The Gas Board's costs have increased by half a million pounds due to dearer coal and transport.

GAS BOILERS IN DURHAM UNIVERSITY'S NEW BUILDING



Left.—The 'Thermax' automatic gas boiler.

Below.—General view of the boiler installations.



CROWDS lined the thoroughfares from the Central Station to King's College, Newcastle, to give a rousing welcome to H.R.H. the Duke of Edinburgh when he officially opened the New Stephenson Building which is to house the Mechanical and Marine Engineering Department of the University of Durham.

The building itself is of a pleasing design and is equipped with the latest types of specialised machinery, the whole project being carried out to the design of the Architectural and Engineering Departments of the College. During his tour of inspection His Royal Highness had a talk with the boiler operator, Mr. S. Easter, who served with the Duke when he was a midshipman.

The boiler installation is of some interest since, while employed for the space heating of the building, it was primarily designed for the training of students and the provision of the requisite steam requirements of the Chemical and Heat Engines Laboratories. Three boilers of different types were thus installed and careful interlinking of all steam production and consumption points had to be arranged in order to provide, under all conditions, the various facilities required. The boilers consist of one Clarke Chapman 'Bidrum' water tube boiler rated at 6,000 lb. per hour evaporation at 220 s.i.g. and 440°F. one Ruston and Hornsby horizontal 'Thermax' boiler rated at 6,000 lb. per hour at 120 p.s.i.g. and one Cochran-Kirke 'Sinuflo' vertical boiler rated at 4,000 lb. per hour at 150 p.s.i.g. The 'Thermax' boiler is completely automatic in operation and fitted with the latest electronic flame failure protection devices.

The building is sited in a predominantly residential district and the avoidance of any nuisance from smoke, dust and other causes was considered of paramount importance. For this reason, together with its many other advantages, gas was shosen for the firing of the three boilers, and this has resulted in the achievement of an exceedingly compact installation of high efficiency. The supply into the building itself consists of a 12 in. gas main terminating in the meter house containing a 35,000 cu.ft. per hour Holmes meter allowing margin for operating two boilers simultaneously.

CONSULTATIVE COUNCILS IN SESSION

North Thames: 1½d. per Therm Increase

THE North Thames Gas Consultative Council at a special meeting on January 17 accepted an increase of 1½d. per therm in the price of gas throughout the area announced by Mr. Michael Milne-Watson, Chairman of the North Thames Gas Board. The increase, which takes effect from February 1 and applies to all gas sold under special tariffs as well as that sold at the flat rate, covers the 0.9d. per therm increase foreshadowed at the meeting of the Council in November and a further rise of 0.6d. per therm attributable to dearer coal and freight charges.

Mr. M. Milne-Watson, who was accompanied by Mr. F. M. Birks, Deputy Chairman of the Board, and Mr. O. W. Wells, Chief Accountant, recalled that in November the Board informed the Council of increases in cost that would make it necessary to increase the price of gas by 0.9d. per therm. Those increases were then estimated to be £1,446,000 a year. The Council was then informed that the date of the increase in price would be left open pending consideration by the Board of the possible effects of the increase in mine workers' wages.

The National Coal Board had now announced increases in the pithead price of coal which, after taking into account revenue from coke and breeze, would cost the Board another £915,000 per annum. It had now been found that the increases in rail freights that became effective on January 1 were considerably more than was included in the November statement, and that on that account it would be necessary to find a further £140,000 per annum. The figures for the annual increase in cost to the Board therefore became:

		Per Annum.
Increase announced in November ...		£1,446,000
Net increase in cost of coal	£915,000	
Additional increase in freights ...	£140,000	
		£1,055,000
Total		£2,501,000

To meet the added burden of £1,055,000 per annum an additional increase of 0.6d. per therm would be necessary, making a total of 1.5d. per therm. The flat rate price would go up from 17.6d. to 19.1d. per therm and all prices under special tariffs would be increased by 1.5d. per therm.

Alleged Discrimination

Mr. Milne-Watson said the Board was perturbed by the present situation. The increase it was asked to bear was not merely an addition passed on equally to other users in order to cover the National Coal Board's additional costs, but was a discrimination against the gas industry by means of a new method of charge introduced by the National Coal Board.

'This new method,' said Mr. Milne-Watson, 'is based on some new evaluation of coal, but we have not been told the final basis on which this evaluation is to take place. We are therefore like a man going into a shop to buy some goods and being asked what he intends to use them for before being told the price. The situation as it appears to us is even more unfair because of the National Coal Board's decision to charge industry on the new evaluation basis, while the domestic consumer will be charged on an entirely different method of group price in various zones. This therefore amounts to the fact that an identical coal can be sold at one price to the gas industry and at another price to the domestic consumer.

'I should not like you to think that I am talking loosely when I complain of discrimination. Since 1938 house coal has doubled in price, and anthracite nuts have increased in price two and a half times. Gas coal, however, has increased three and a half times. These figures are approximate, but give a clear indication of what would appear to be the policy of the National Coal Board to penalise the gas consumer.'

Matter of Duty

He had felt it his duty to bring these facts to the attention of the Consultative Council, not in criticism of the National Coal Board in so far as it was directed to make ends meet, and not of any decision of the Government if in fact it was part of the Government's policy, but because as gas consumers they were vitally affected. The gas industry was making efficient use of the nation's coal and it was to be hoped that the Ridley Committee now considering fuel policy would closely examine the National Coal Board's new price policy which appeared to be directed against the gas industry.

As an amendment to a formal proposal to accept the increase, Councillor W. R. Cowen (Harrow) moved that the time was not oportune for an increase in price and that a further examination of the accounts should be made with a view to meeting the increased costs by further economies.

The amendment was lost and the resolution carried.

Councillor Cowen later moved that the Consultative Council should ask the Minister of Fuel and Power to look into the question of discrimination in the matter of coal prices. After a lengthy discussion, in which it was urged that any readjustment in price structure would tend to raise the cost of coal to the poor solid fuel consumer, the resolution was not carried.

Public Lighting

At a previous meeting members had been invited to make written requests for information arising out of the Board's report and accounts for the year ended March 31, 1951. Several of these requests were answered by Mr. Milne-Watson and Mr. Wells. Speaking of economies, Mr. Milne-Watson said the Board had closed the gasworks at Windsor, Marlow, and to a great extent at Maidenhead where cost of production was high and reconstruction was not justified. As to the low average price received for gas for public lighting, the Chairman said the Board had contracts with most of the local authorities in its area, and wherever it was felt that embarrassment would have resulted from terminating contracts overnight the Board had decided to allow contracts to run their full course.

'Not all contracts have been treated with such sanctity by the Board,' commented Councillor Cowen, an accountant by profession, who raised several highly technical questions on the accounts.

Mr. Wells dealt with Mr. Cowen's questions and was thanked by Mr. Cowen who submitted that on such complicated points he should have been provided with written answers.

Mr. Milne-Watson said that with all the goodwill in the world the Board could not change the form of its accounts to please Mr. Cowen; their form was laid down by the Minister of Fuel and Power and it would be for Mr. Cowen to ask the Minister to take steps to amend the Gas Act.

Councillor E. Bayliss, Chairman of the Council, announced that at the meeting of the Council on January 31 Mr. O. W. Wells would address the members on the accountancy methods of the Board.

West Midlands: Coal Price Protest

ADDRESSING the West Midlands Gas Consultative Council at its meeting in Birmingham on January 14, Mr. G. le B. Diamond, Chairman of the West Midlands Gas Board, said the march of events had brought heavy and serious additional costs to the Board during the past few months. As recently as December 20, the National Coal Board introduced its new coal price structure, to take effect as from December 31, 1951, which imposed an additional burden on the Board of over £1 mill. per annum. The increased costs which had accumulated since November brought the total up to approximately £1,358,000, from which must be deducted the recent increase in the price of coke. The new tariff structure, which the Board proposed to place before the Consultative Council, would have to be altered.

Everyone accepted the position that mining was a hazardous and unattractive industry and that the miners must be well paid. It was understood that the new

wages award and the pension agreement would cost £26 mill. a year. In addition, the miners had been granted another week of paid holiday, which would cost a further £8 mill. The mining industry had, of course, to carry the additional costs which had occurred through the general increase in prices and they had borne the substantial losses on imported coal. There was, however, another factor which should be known to the Consultative Council for the National Coal Board had adopted a new policy for the evaluation of coal. In the new price schedule there were different price levels for various groups of coal in accordance with the estimated value attaching to the coal, derived from an analysis and the award of a points value. In general, coals had been grouped according to their suitability for (a) carbonisation, (b) domestic use, or (c) industrial use.

The result of the new price structure was that the gas industry was obliged to pay a larger increase than any other consumer. From calculations, the increases were:

	%
Gas industry	12
Electricity industry	5.8
Iron and steel industry ...	10
Coking industry	11.8
House coal	10
General industry	8.4

If all the coal from the same seam in the same pit (which was suitable for carbonisation) was reserved for the gas industry and priced in accordance with the valuation, there could be little reason for complaint but, in point of fact, this was not the case for a large quantity of coal, identical to that supplied to the gas industry, went to the house coal trade and to general industry at the lower price.

The Consultative Council might consider that it was unfair that the consumers of gas should be called upon to carry such a heavy additional burden, more especially, when it was realised that the efficiency of carbonisation was over 70% whereas the same coal diverted to industry or to domestic use was consumed at a much lower efficiency and the valuable by-products were lost. It might be thought that, in the national interest of using our coal resources to the best advantage, there was a case for reducing the price of coal to those who used it with the highest efficiency and increasing the price as the efficiency of usage fell. It could not be argued that the National Coal Board was paying the miners extra money to win gas coal for that coal sold at the lower price came from the same seam.

Pottery Industry

The new situation was particularly serious to the pottery industry which was one of the most valuable dollar earners for the nation. The increased costs would fall heavily on the industrial and domestic consumers of gas in that area for, in addition to average increase of coal for the whole area, there was the added complication that the National Coal Board was withdrawing more and more Staffordshire coal from the gasworks, although it did not appear to do so on that section of the pottery industry using Staffordshire coal in bottle kilns. In place of the Staffordshire coal, which by tradition had been supplied to the gas undertaking for many years, the National Coal Board was now substituting coals from the North Eastern and West Midlands divisions at a heavily increased price, largely due to the freight charges incidental to a longer haul. The additional charges were likely to amount to no less than £30,000 per annum and it was difficult to follow the reasoning for the importation of coal of gas making quality from such long distances away as the North East while sending Staffordshire coal an equally long distance out of the area.

In reply to a question, Mr. Diamond said less and less coal was being won from the Staffordshire coalfield and they were obliged to make up the difference from outside, but it was also known that coal was being sent away from the area. The Board did not grumble, he said, at having to pay for high grade coal but it was felt that it was not right for coal to be taken out of the same box and charged at a lower rate to other people.

A resolution was passed accepting the need for the N.C.B. to recoup itself for extra expenditure on miners' wages and materials but protesting to the Minister of Fuel and Power against the discriminatory manner in which the increases had been applied so that the average additional cost per ton to the gas industry was greater than to any other class of user. The resolution also regretted that coals of the same quality and characteristics were sold to different classes of users at different prices and moreover coals which were eminently suitable for carbonisation were used for other purposes necessitating the carbonisation by the gas industry of less suitable coals. The Minister was further requested to take such action as would lead to the cessation of the discrimination against the gas industry and an adverse effect upon gas prices.

North Western Meter Rents

EVERY six months the North Western Gas Consultative Council, with members of the North Western Gas Board, is to meet representatives of local Authorities, so that these authorities can ask questions or offer criticisms about the working of the Board. At a meeting last week in Manchester, Councillor A. F. Hartle (Buxton) stated that the high price of gas was making it uneconomic for bakers to use gas-fired ovens. Charges for industrial gas in the Buxton area had been increased from 9d. a therm to a sliding scale varying between 1s. and 1s. 4d., according to the amount consumed. These prices would force small bakers out of business. One man had received a bill for the September quarter of £127 14s. 3d. While those prices might be all right for large bakeries, which used their ovens throughout the day and night, they were too high for the small man.

Councillor C. E. P. Stott, Chairman of the Consultative Council, said that they had met a deputation from the North West Bakers' Association on the particular question, but the meeting had been adjourned for the bakers to make representations about the charge they considered should be made, and he could offer no further comment at present.

Standardisation

Mr. A. Henshall, Deputy Chairman of the Gas Board, said that under the Gas Act they could not show undue preference between one consumer and another. What was being done was to try to standardise charges for industrial gas irrespective of the type of consumer.

Councillor E. Hodson (Stockport) protested against the Board's decision to make a charge of 2s. a quarter to each domestic credit consumer, and a charge of 1d. per therm on the price of gas supplied through prepayment meters to cover the meter charge.

He said there had been a deficit of £305,000 by the Gas Board in 1950-51, and the Board should have been honest with consumers, and increased the charge for gas, instead of putting the 2s. meter rent on in some areas, to raise more revenue.

Councillor Mrs. R. B. Heathcote (Bredbury and Romiley) said formerly she paid 9d. a quarter for her meter, but since the Board had taken over, though the meter had not been altered, its value had now increased to 2s. a quarter. She protested against low pressure gas on Sundays, the only day on which housewives got some meat to cook.

Councillor Stott, replying, said the Board had actually made a profit of £200,000 in round figures, and the deficit was solely due to the fact that retort repairs, normally spread over five years, were being met out of revenue. He characterised the resentment about meter rents as largely psychological. Out of 103 undertakings assimilated by the Gas Board in May, 1949, in 68 of them the policy of charging meter rents was operating. So-called free meters operated in 35 undertakings. The Board, however, was taking steps towards adopting uniformity of practice, and as the majority of undertakings were charging such rents, the others would be brought into line. He did not consider 2d. a week excessive.

Mr. W. Hodkinson, Chief Technical Officer, promised improved pressure in the Bredbury area towards the end of the year when pipes would be laid from Hyde.

Published as a 'Grey Edition' by the Institution of Gas Engineers is Communication No. 385/182, 'Some Aspects of Gas Manufacture Practice in the North Thames Gas Board Area,' by Dr. J. Burns, G.M. It is available from the Institution at 17, Grosvenor Crescent, S.W.1; price 2s. 6d. post free.

Sales Management.—The Council of The incorporated Sales Managers' Association announce that the qualifying and final examinations in sales management will be held in London and various provincial centres on May 22, 23 and 24. Entry forms and particulars may be obtained from the Secretary 4, Holborn Place, London, W.C.1. Closing date for entries will be April 30. The Association will introduce in 1953 a revised six-subject qualifying examination in lieu of is present qualifying examination consisting of theree subjects only, thus bringing this examination into line with the national certificate scheme in management studies.

G. L. HOWARTH'S NEW WORKS AT BURNLEY

WE recently had the opportunity of visiting the new works of G. L. Howarth & Co., Ltd., at Nelson Square, Burnley. Established in 1889, the firm, which manufactures domestic washing machines and wash-boilers, has made substantial progress, and this has necessitated the move to the new and larger premises, which are centrally situated and readily accessible.

The new factory, which is all on one floor, has been laid out on approved modern lines and will facilitate greater production of gas appliances. From receipt of the new raw materials, the work progresses in efficient sequence to the final packing and despatch departments.

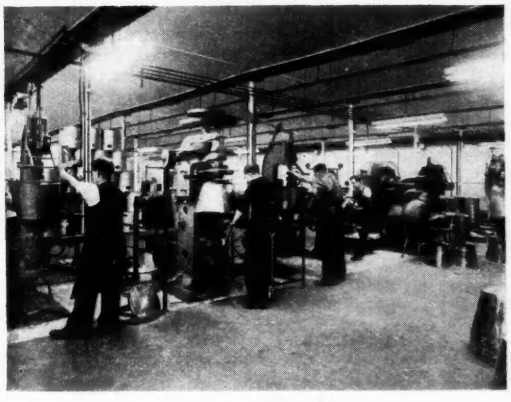
The latest types of sheet metal plant are installed and no effort has been spared to meet the requirements of a continually increasing production. It may be mentioned that all presses and manufacturing machines have individual electric drive.

The various manufacturing processes are carried out in a large central workshop, the tinning department being segregated in a separate shop, thereby isolating this particular section from the remainder of the works. There is also another separate shop for grinding and polishing the various components. As manufacture nears completion there are four final assembly lines for (a) Rapid washing machines; (b) Minor washing machines; (c) R5 square boilers; and (d) round boilers.

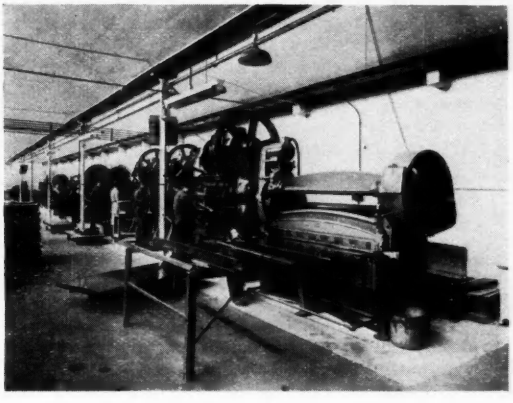
Lighting of the factory is by modern fluorescent fittings, and the heating of the works is by Bratt Colbran overhead panel heaters. The offices are centrally heated by an Ideal gas boiler. All gas installations were supplied and fitted by the Burnley undertaking of the North Western Gas Board. The welfare side has been well catered for by the provision of an up-to-date, comfortable canteen.

Unfortunately the senior Director, Mr. T. T. Howarth, did not live to see the completed works, although the benefit of his advice and great experience was available when the building was purchased and at the start of the planning and layout. The final result reflects great credit on his courage and on the enterprise of Mr. H. Baldwin and Mr. Hartley Howarth, Joint Managing Directors. The sales side, under Mr. Alex Kennedy, Sales Manager, is now able to give improved service to the gas industry.

A Section of Despatch Department.



Fabrication of Washer Pans.



Press Shop.

FLUES FOR DOMESTIC APPLIANCES

THE Council for Codes of Practice for Buildings has issued in final form Code 131,101 (1951), 'Flues for Domestic Appliances Burning Solid Fuel.' It has been drawn up by a Committee convened by the Royal Institute of British Architects on behalf of the Council, and is a revision, following comments received, of the draft code previously issued.

The code deals with flues and chimneys depending for their operation on natural draught, and includes recommendations regarding chimneys built of brick, stone-masonry, cast-in-situ concrete, pre-cast concrete units, and hollow block; metal and asbestos-cement flue pipes are also included. Its scope is restricted to flues and chimneys serving appliances with a maximum heat output of 100,000 B.Th.U. per hour where the temperature of the flue gases does not exceed 850°F.

The section on materials, appliances, and components describes in detail a wide range from which a selection, according to design requirements, may be made. A comprehensive list of relevant British Standards is included.

Particular interest will be found in the section on design considerations which are examined in general and in detail. Information is given on the size and height of flues recommended for changes of section and terminals, and on the height and position of chimneys above the roof in relation to fire hazard and wind effects. Attention is given to prevention of damp penetration and to many details of works on site.

There are eight diagrams illustrating the text. An appendix sets out the causes of condensation in flues and suggests methods for reducing the formation of condensate and for protecting the chimney walling from the effects of attack.

The code carries the usual warning that during the abnormal conditions it may not be practicable to carry out all the recommendations. Copies may be obtained from the British Standards Institution, 24 Victoria, Street, London, S.W.1, price 5s. post free.

GAS LIQUOR AS AN AGRICULTURAL FERTILISER

An account of some initial experiments in the direct application of ammoniacal liquor to farm crops and grass

By F. CLIFTON SHERRIFF,
Assistant Editor.

MANY stories owe their beginnings to chance word or casual meeting. This one springs from the quite fortuitous meeting in a railway carriage between myself and a former colleague on the N.A.A.S., both bound for the Royal Show at Cambridge last year. When our conversation turned to 'shop'—as most conversations nearly always do between people interested in the same industry—he remarked that a number of experiments in the direct application of gas liquor as a fertiliser had been taking place in our home county of Hampshire.

By a curious coincidence, further reference to the subject had come to the *Journal* about the same time in a paper by Dr. A. Marsden (Area Scientist to the South Western Gas Board) in his paper to the South Western Section of the Institution of Gas Engineers (see issues of July 25 and August 1, 1951). As a result of these two entirely unrelated circumstances I felt that some further investigations into the subject might prove of interest to readers, and I set out to discover what was going on in Hampshire.

Still in Infancy

I very soon found that although a considerable amount of work had been done, covering hundreds of acres and representing millions of gallons of liquor, the whole thing was still very much in its infancy ; and while many of the trials give promise of outstanding results, others are disappointing and indicate the need for long-term research of a much more scientific nature than has been conducted hitherto.

With the important qualification, therefore, that my observations must essentially be regarded in the light of a preliminary review, I am setting out just a few of the impressions gained from visits to a number of Hampshire farms where the Southern Gas Board has pioneered experiments in the large-scale distribution and application of gas liquor, under the supervision of Mr. H. M. Lawrence, General Manager of the Portsmouth undertaking. Until the Ministry get down to some much more scientific work on their own experimental farms (as I believe they are intending to do) the gas industry must rest content with the assurance that the matter is receiving attention in 'official circles.' In the Ministry's good time I have no doubt much more valuable data will be added to these brief notes on the experiences of some practical farmers who have been courageous enough to try liquor spraying on their land with little knowledge in advance of whether it would bring riches or ruin.

No attempt has been made to give truly comparative figures on resulting yields for the simple reason that few are yet available and those that are may be misleading in the absence of proper 'control' plots and without due consideration of such factors as varying soil conditions, quantities of other organic and inorganic fertilisers applied, time of dressing, weather, and so forth. Some of my conclusions may be proved wrong after further trials ; some of the poorer results I witnessed here and there may be capable of vast improvement by some simple adjustment in spraying technique or liquor strength. Time alone will show. What I feel is more important is to stimulate now the interest of both industries in the use of gas liquor as a fertiliser, to break down prejudice, and to encourage more farmers and gas undertakings in every part of the country to carry out experiments.

No New Idea

There is nothing new in the idea of applying nitrogen to the land in this particular form. It has been known for many years ; but it is only as a result of the comparatively recent and continuing world shortage of sulphur (which curtails the ability of the gas industry to work up its liquor to produce sulphate of ammonia) that any serious attention has been given to it.

As long ago as 1923 reference was made in the *Journal* to the melancholy experience of a Yorkshire gas manager who tried during the latter part of the first world war to interest local farmers in gas liquor. His efforts, I should add, were not engendered by a spirit of pure altruism since he was having to pay 8s. a ton to get rid of it. Due perhaps to the comparative scarcity in those days of suitable spraying equipment, coupled with a not unnatural suspicion on the part of farmers of a 'chemical' which may have been thought to have an injurious effect on plant life, no one availed himself of the offer.

Lincolnshire Trials

Twenty-seven years passed before the subject again found any material mention in these columns, despite the fact that disposal of gas liquor had continued to be something

of a problem in many undertakings. We then published details of experiments in Lincolnshire on a variety of crops, the overall success of which inclines one to regard them with some reserve. I will, however, quote them briefly.

Arable land was treated before and after seeding, as also were young crops during growth up to 1 ft. high, there being no depressing effect on germination. On one 10-acre field of potatoes five acres were treated with farmyard manure and the other five with liquor. The latter was stated to give a bigger yield and in the following year produced a better crop of wheat. Liquor was used on grass and silage crops, and pastures were alternately dressed and grazed throughout the dry summer of 1949; and when most pastures were poor and milk yields falling, both the quality of the grass and the milk yields on this particular farm were maintained. Up to 1,500 gal. per acre was reported to have been used of liquor of about 10 oz. strength, though it is not clear—indeed, it seems most unlikely—that this quantity could have been applied in a single dressing. It was further stated that 500 gal. of this liquor was estimated to be equivalent to 5 cwt. of sulphate of ammonia, whereas according to the calculations which I set out later I make it the equivalent of no more than 4¼ cwt. of sulphate of ammonia—which in itself seems a somewhat excessive quantity for one dressing, being of the order of 100 lb. of nitrogen per acre.

Nevertheless, these Lincolnshire experiments aroused considerable interest, and the results were confirmed by members of the advisory staff of the Ministry of Agriculture. No detrimental effect on stock was noticed, even though pastures were grazed very shortly after application of the liquor. A yield of sugar beet of 16 tons per acre was obtained from land to which the liquor had been applied. Since using the liquor this farmer has dispensed with the use of all other nitrogen fertilisers and is now applying, in addition to the liquor, 4 to 6 cwt. of superphosphates and 1 cwt. of potash per acre, together with F.Y.M. The saving effected in dispensing with sulphate of ammonia has enabled him to increase the quantity of phosphate. Regular application of the liquor all the year round, using wide spreaders, has been found most satisfactory, and the farmer is of the opinion that his new system gives balanced fertilisation.

Before proceeding to my own observations it may be well to set out the following comparative figures as between gas liquor and sulphate of ammonia:

Gas Liquor

Nitrogen content at 10 oz. strength, 2% by weight
224 gal. = 1 ton.
400 gal. per acre = 4,000 lb. of liquor = 80 lb. nitrogen

	s.	d.
Southern Gas Board inclusive price for spraying at this rate, per acre (£6 6s. per 1,000 gal.)	50	0

Sulphate of Ammonia

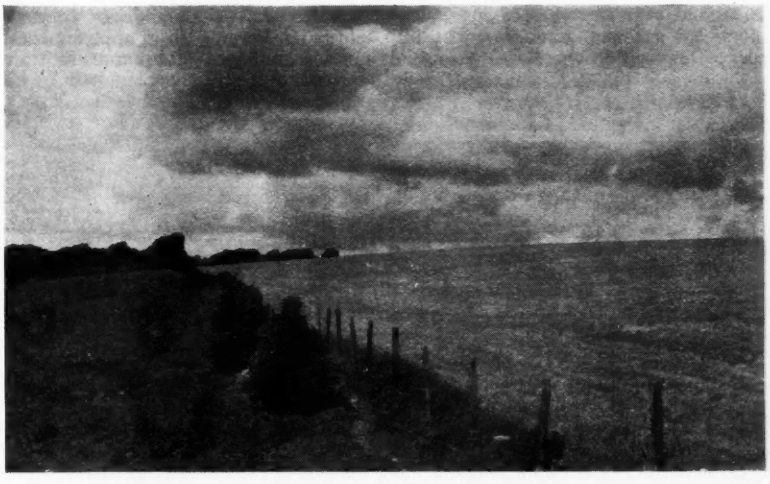
Nitrogen content, 21% by weight
1 cwt. therefore contains 23½ lb. of nitrogen
To supply nitrogen at the same rate as liquor at 400 gal. per acre (*i.e.*, 80 lb.) requires approximately 3½ cwt. of ammonia.

3½ cwt. of sulphate of ammonia at, say, 15s.	52	6
Plus labour charges computed at approximately ...	5	0
	61	0

These figures indicate a material advantage in favour of gas liquor at current prices, though I note again that the amount of nitrogen applied is somewhat higher than many farmers are in the habit of using in the form of sulphate of ammonia.

Several of the Hampshire farms I visited are on chalk, and tend to lay emphasis on corn and seeds production, though in one instance very large numbers of cows are kept on the bail system and considerable importance is attached to silage crops and to high quality grassland, where liquor was applied to both permanent pasture and 2-3 year leys during the spring of last year.

Immediate and serious scorching, particularly of the clover, was noted in most cases, and on at least one field the first silage cut was estimated at 50% below normal expectations—though at the time of my visit it was showing a very good second growth. The initial striping was, however, still apparent, and although there was a fair crop of seed the weather did not permit it to be cut and it was allowed to grow rough for winter feed, and is providing some useful keep at the time of writing. Nevertheless, the farmer feels that the total production of this field will not be anything like what it should have been; what was lost by burning action was lost completely and not recovered later. In extenuation, however, it is fair to say that the initial spraying was carried out rather later than is generally desirable, due to unfavourable weather.



The field on the right, reserved for silage, was sprayed towards the end of May, 1951, about a week before the photograph was taken. The contrast between this and the adjoining field is clearly discernible.

It was noted that on this farm the results were better on permanent pasture than on temporary leys, and it is clear that the dressing should not be applied much after the end of March to get the best results in that season. Application in May proved definitely harmful.

So far as it is possible to judge from these initial experiments, gas liquor is less attractive to the seeds grower than to the farmer growing straight fodder crops, since it appears to have the effect of stimulating leaf growth at the expense of seed. I noted on another visit a particularly strong growth of grass, following spraying, for sheep grazing. It was intended to experiment with the liquor for rotting down straw left behind the combine, but again the weather prevented this being done.

An Enthusiastic User

The most enthusiastic user of gas liquor I found on a farm in the south of the county on a very difficult type of soil—brick earth overlying gravel, some exceedingly poor. It may be for this reason that the results were substantially more encouraging than many of the others. Here both gas liquor and sulphate of ammonia were used

side by side in what was probably one of the most reliable comparative tests of any, and results definitely favoured the liquor. After application of both types of dressing there was a grazeable growth sooner on the section treated with the liquor. It was, in fact, possible to turn the cows on to the pasture within a fortnight of spraying.

One field had a dressing of basic slag in the autumn, sulphate of ammonia in the spring, and gas liquor in early July. From then on it was grazed heavily; and at the time of my inspection in mid-August there was still plenty of bite, whereas in other years, the farmer told me, they were by this time supplementing the feed. After using the liquor the pasture was sufficient in itself for both maintenance and average production apart from a small ration of concentrates at milking time.

Outstanding Effect on Water Meadow

But perhaps one of the most outstanding results of any was the effect of liquor on some water meadows—which were really little more than semi-derelict marshland. Within a few weeks of spraying with gas liquor there was a luxuriant growth of quite good quality grass, which I was assured was double the normal.

On another farm experiments were carried out on grassland—both temporary and permanent. For example, following a light cut and summer grazing, a long ley in its second year was dressed in September at the rate of about 200 gal. per acre. Even at this somewhat lower rate of application there was the usual initial scorching, but within three weeks there was an exceptional growth. On this farm, too, there was an interesting experiment on a water meadow, again almost derelict, which was sprayed at the rate of 400 gal. per acre. While the striping was very marked and recovery slow, a hay cut of two tons per acre was taken—which was regarded as exceptional for the type of land.

Another field on this farm, a one-year ley, was sprayed after an early silage cut at the rate of approximately 200 gal. per acre (by the not very reliable method of applying the normal strength liquor at a higher tractor speed). In this case there was nothing like the same degree of scorching and recovery was quick. A tendency for the liquor to produce stalkier ryegrass was noted on this farm.

I carried out a few small-scale experiments on my own land with a liquor rather below normal strength and obtained one or two quite interesting results. A small section of hay aftermath was dressed shortly after the cut, together with a section of permanent pasture which had been shut up for autumn keep. In both cases there was immediate scorching, particularly of the clover. Unfortunately, finding myself short of grazing, I was obliged to turn my heifers on to the aftermath before recovery of the dressed section was complete—which rather spoilt the experiment but provided one interesting feature. The heifers made straight for the dressed section and, though it was still brown, grazed it right down before touching the rest, which suggested that not only did they like it but that it was quite innocuous. The section of P.P. completely recovered within a few weeks and showed quite a good growth. The area had previously had a dressing of sulphate of ammonia at the rate of 1 cwt. per acre.

Applied to Cattle Kale

Liquor was also applied to a few 'control' rows of marrowstem cattle kale—at ground level in the seedling stage (2-3 in.), and later when the plants were 12-18 in. high. There was a not unexpected darkening of the leaves and, subsequently, a strong growth, showing advanced development over the untreated rows. Drops of the liquor splashing on to the leaves produced burnt spots which, however, largely disappeared. I also (perhaps rather unwisely) tried a little of the liquor on one or two indoor tomato plants at the stage when the fruit was beginning to form. Over the results of this experiment I will draw a discreet veil! I gained the impression that unless the application is very carefully controlled there is a tendency to weaken the stems of brassicas. I was unable to prove any marked result from applying the liquor to mangolds, but it was certainly not harmful.

This photograph clearly shows the striping effect of gas liquor spraying. In this particular case the liquor was applied a week before the photograph was taken. The field had been grazed continuously throughout the previous winter.

Contrary to what one might expect, there is believed to be less tendency to leaching with liquor than with sulphate of ammonia—as suggested by the fact that the beneficial effect is often more marked on the *second* crop than the first. It should be appreciated that the scorching is due in the main to adhesion of the liquid to the leaf; consequently, within reason, the heavier the dressing the less likelihood of adhesion owing to the more complete run-off. In acid soils where nitro chalk is used in preference to sulphate of ammonia, the advantages of gas liquor may be less obvious.

West Midlands Experiments

While writing these notes I chanced to see in a contemporary a brief reference to trials by the West Midlands Gas Board in the Redditch area, an interesting feature of which was the irrigation of the ground immediately after the liquor had been applied. This had the effect, it was stated, of greatly reducing the scorching; though if by 'irrigation' is meant a further spraying with water I cannot see precisely what advantage this has over a simple dilution of the liquor, which I should have thought would obviate the additional labour costs involved in going over

the ground again spraying water. It might be asked: 'Why not spray just before rain is forecast?' But with a capricious climate such as ours this might well prove an unreliable practice.

The report of the Redditch trials also stated that 1,200 gal. of liquor was equal to 4 cwt. of sulphate of ammonia, which indicates that the liquor is below 10 oz. strength, since this quantity would otherwise be equivalent to about 10 cwt. of sulphate of ammonia. While I have heard of farmers using as much as 8 cwt. of sulphate to the acre at one dressing, I would say that this is an unusually high rate and the exception rather than the rule. In computing nitrogen equivalents it should, of course, be borne in mind that there is an inevitable evaporation of free ammonia during application with a consequent reduction in the amount of nitrogen available as a fertiliser.

At any rate, I hope to learn more of the West Midlands experiments in due course. Meanwhile it can be stated that where the liquor was used on grassland there was a marked increase in herbage, while application to stubble immediately prior to ploughing and drilling resulted in some useful root crop yields.

Throughout these notes I have used the word 'spraying' to describe the method of application. This is not, of course, a strictly accurate definition of the process since the liquor is applied through a series of *jets* on a wide boom, thus producing the striping which is always apparent. It is considered (in Hampshire at any rate) that it is less likely to promote scorching—by adhesion, as mentioned above—to 'pour' the liquor on rather than spray it. It is felt that quite considerable losses of nitrogen may result from spreading the liquor on the surface—and the finer the spray the greater the loss. There is still much to be learned as to the best method of applying gas liquor. Where it has slopped over during the filling of the tank the ground has become completely sterile, though how long it remains so I have not yet ascertained. It is clear, at any rate, that the liquor calls for careful handling.

Need for Research

In the paper referred to earlier, Dr. Marsden observed that while the continued use of sulphate of ammonia brings about a lack of calcium by base exchange, any such loss brought about by gas liquor is likely to be comparatively slight because most of the ammonia is not combined with inorganic anions. The Lincolnshire experiments were on Lower Lias Limestone, so the effect was not a problem. Long-term experiments are, as I have said, needed to settle such questions as whether the continuous use of liquor alters the micro-biological flora sufficiently to allow the build-up of toxic materials to levels which will cause damage to plants. It may be mentioned that in both Germany and Denmark the liquor has been used successfully on a wide variety of crops.

Mr. J. B. E. Patterson (Provincial Advisory Chemist, N.A.A.S.) has observed that it is unlikely that damage would occur to soil bacteria and other organisms from phenols, thiocynates, and cyanides provided reasonable dressings are applied. He, also, points to the need for more experimental work to settle this point, as well as the alleged long-term damage to clover, destruction of viability of seed, and alteration of pH and soil structure, some of which are already being investigated. In Mr. Patterson's view the most suitable use for gas liquor is on old grassland soon to be ploughed up. He observes that grass is damaged by scorching least of any crop, whereas application to arable crops can safely be made only by direct application to the soil. It is possible that good results might be obtained by using equipment similar to that used in America on a large scale for the distribution of liquefied ammonia (not solution), in which the fluid passes down through coulters and reaches the soil 1 to 2 in. below the surface.

The Southern Gas Board does not itself directly undertake the spraying. It is handled through the agency of a firm of agricultural contractors—Growers' Services (Emsworth), Ltd.—who are conveniently situated in relation to the Portsmouth gasworks from which the bulk of the liquor is drawn. It is transported from the works in 1,000 gal. tank wagons and applied by equipment specially calibrated to deliver the liquor at 400 gal. per acre at normal tractor speed of 4 m.p.h. With the object of getting the liquor on to the land as near as possible the stated strength of 10 oz. it is actually a little above this level (about 11 oz.) at source.

It will be appreciated that the vast proportion of the cost of the operation must obviously be chargeable to labour and transport and only a comparatively small proportion to the liquor. Consequently, the Gas Board's price of 50s. per acre cannot economically be varied *pro rata* should a farmer desire a lighter application of nitrogen, since the cost of the operation would be substantially the same with a diluted liquor. In any case, dilution at the works cannot be regarded as sound practice inasmuch as it entails carrying water about the countryside. I think this may be regarded as a slightly unsatisfactory feature, because the majority of farmers have probably been in the habit of using a rather lighter dressing than 80 lb. of nitrogen per acre and may be reluctant at first to apply a heavier dressing in the form of liquor. On the other hand, when initial prejudice to the heavier dressing is broken down and the advantages are generally realised, not least of which is less cost to the farmer, we may look forward to much wider use of gas liquor.

It will be interesting to learn whether it is better to apply a greater quantity of a weaker liquor or a lesser quantity of a stronger liquor. In theory it should not make much difference, financially, at the gasworks end; but at the other end a greater quantity of a weaker liquor may possibly involve higher operating costs on the farm and if sent out weak from the works must involve higher transport costs as compared with a stronger liquor. If it is diluted at source, however, there is relatively less evaporation of free ammonia.

Questions Unanswered

It will be recognised that I have left a number of questions unanswered. Some of them will not be completely answered for some years—not until there have been many more scientific trials under varied conditions. Others will, I hope, be clarified as soon as the present 'hush hush' policy which has been imposed from 'way up top' has been lifted. I understand that the Gas Board and the contractors have been requested to submit detailed reports to the Lord President of the Council—and until these have been studied the whole subject must be (officially) cloaked in secrecy and shrouded in mystery. From such inhibitions the farmers themselves are refreshingly free. If Longfellow had been alive today he would assuredly have said: 'Sail on, thou Censorship of State!'

In giving credit to the Southern Gas Board for the pioneer work in Hampshire, I must also mention the great interest and ready co-operation of the N.A.A.S. in the county, who are working in close collaboration with the Board in investigating this problem. Indeed, they went so far as to recommend the Ministry to purchase from Denmark a liquid manure drill for the purpose of experimenting with injection into the soil instead of spraying. This drill is now in the country ready for operation this coming spring, and the results of its work will be awaited with the utmost interest.

I wish to record my personal thanks to those Hampshire farmers who so kindly granted me facilities to see the results of the experiments on their land. Among these I should particularly mention Mr. Gilbert Harris, Mr. J. P. Spring, Mr. Rex Paterson (to whom I am indebted for the accompanying photographs), and Mr. John Rowsell. I have not in this review attributed specific views, or successes or failures, to any individual, but have rather tried to draw some general conclusions from the experiences of them all.

A Review of Current Thought

ON THE SERVICE SIDE

WITH the stimulus of the Gas Service Conference ahead, and the satisfaction of an excellent year's sales progress behind, the industry's sales staff do not appear to be letting such current difficulties of appliance supply discourage them. Judging by the activities of the various Salesmen's Circles, the reverse is the case. In the following notes we present opinion among the sales staffs, as revealed by recent addresses to these bodies.

We begin with Mr. T. E. Moorley's Chairman's Address to the Southern Area (Northern Section) Circle. Mr. Moorley is Industrial and Commercial Representative at Oxford and his paper dealt primarily with salesmanship, with particular reference to the salesman's place in a nationalised industry. Is he an unimportant cog? Mr. Moorley is convinced that he is not, and points out that a machine is designed to a performance standard and if any part, however small, is not functioning with full efficiency the performance of the machine as a whole is lowered. In his view, there has never, in the whole history of the gas industry, been a period more challenging and therefore stimulating to the salesman than the present. He has to encourage, by every means in his power, the sale of gas and coke though both these commodities may be in short supply in his particular area. At the same time, owing to relatively high costs and in the national interest, he must ensure that both these fuels are used in the most efficient manner possible. This means the prompt scrapping of obsolete and worn out apparatus. In addition, there is the difficulty of obtaining, within measurable delivery time, an increasingly wide range of modern gas apparatus and fittings.

'Responsible' Selling

This, he suggests, is where selling, in the highest sense of the word, comes into its own, and defines it as 'responsible' selling as opposed to the 'carefree' variety. If a consumer proposes to open a café in a month's time it is of little use to sell him cooking equipment that he cannot hope to obtain for 12 months. Similarly, if a builder proposes to erect 20 houses in a district afflicted with peak load problems, only an irresponsible salesman will suggest putting in high-consumption instantaneous water heaters, without first carefully exploring the possibility of installing low-consumption storage heaters.

The heavy burdens that the present shortage of manpower, particularly skilled manpower, lays upon the fitting and transport departments means that the rash promise to have apparatus delivered and work carried out, without initial reference to the conditions prevailing in these departments, is a major example of irresponsibility. Mr. Moorley admits that it is very easy to fall into this error when dealing with a pressing or anxious consumer, but points out that if circumstances prevent the promise being kept, the salesman is far more likely to have made an enemy than a friend for his undertaking. The remarks he commends particularly to showroom personnel, who, in their 'more rarefied' atmosphere, are apt to get a little out of touch with those behind the scenes who have to keep their promises for them. In an exactly similar category comes the careless pronouncement on the suitability of an appliance for a particular installation without any reference to an initial visit to the premises. Many a later sale has been severely prejudiced by ill-advised remarks at this stage.

Forecasting Delivery

The author insists that the only way the salesman can avoid such errors is to plan his selling from A to Z. He must add to his usual equipment a clear picture of the day to day stock position regarding available apparatus and what constitutes a reasonable delivery forecast for that which must be ordered. Also he must keep up to date with the reports issued by the fittings department regarding the time necessary to carry out work.

This theme is not new—far from it—but it has lost none of its truth with the passage of time. Another Chairman's Address, this time to the South Eastern Section of the Wales Sales and Service Association, is couched in a very different style. The author, Mr. J. H. Scott, Chief Sales Assistant at Barry, has hit upon the novel idea of emphasising the importance of gas in the lives of ordinary people by telling the life story of an imaginary character Mary Jones, from her arrival in a nursing home, through childhood ailments, school life, courtship, marriage, to happy maturity. Throughout her life gas serves her in a thousand ways, and the author's theme is that the knowledge that he was helping to provide that service for the millions of Mary Jones's gives the salesman an added pleasure and belief in his job.

Seeking New Business

Lastly in this group of addresses by chairmen of Circles, we draw attention to the talk given by Mr. S. H. Stokes at the first general meeting of the Lincolnshire Divisional Circle of the East Midlands Gas Board. A particularly interesting section of his address deals with the seeking of new business in the form of housing development.

It is in this field, says Mr. Stokes, that the group and/or local manager has a particular interest, because in Lincolnshire there are so many local authorities, often several miles apart. By reason of the parochial set-up, the local manager must in the course of his business and social attachments become fully aware of what is planned in his town or district and be able to interpret the trend of local thought. He must be qualified to speak with confidence and knowledge on his own particular job, and make himself familiar with the general principles of building construction, and the prospective householder's requirements as to accommodation and services.

The author suggests that in this way is mutual respect and friendship between the board's senior officer, the local officials and contractors built up, and says that he has found that goodwill thus established leads automatically to recurrent business. Thus in one area under his control, where free coal was available to 60% of the community, the whole of the carcassing for 1,000 houses completed in three post-war years was carried out by the undertaking's fitters; wash boilers and an average of about two fires were installed in every house, and cookers in a fair proportion.

If, however, sales cannot as it were be secured 'on a plate,' and the consumer is left with freedom to choose her service, says Mr. Stokes, the district representative will be on the doorstep, if not before, then with the key. He will have confidence that the appliances he puts forward are right for the duty, that gas is the right fuel for the job, and that the prices and terms submitted are the right ones for the consumer's pocket.

Coke Saves Coal

And so, briefly, to coke. The subject was included in Dr. M. Barash's very comprehensive paper 'Fuel Efficiency in the Household,' presented to the Leicester and Northants Divisional Circle. The author's position as Coal and By-Products Officer to the East Midlands Gas Board makes his remarks particularly authoritative. Piously hoping that the present 'coke famine' is a temporary phase, he draws attention to two aspects of the potential increase in the domestic consumption of coke.

Dr. Barash points out that gas coke production (availability for sale) in this country has increased from about 7 mill. tons in 1939 to 10 mill. tons in 1950, and only about 2½ mill. tons of this is used today in the domestic market. If, he says, the virtues of domestic coke-burning appliances are sufficiently appreciated by authority and by the potential consumer, there appears to be no insurmountable reason why, on a short-term policy, this 25% fraction should not be very materially increased. And as a longer-term policy, if domestic coke consumption be appreciably increased, there should obviously be a very material resulting decrease in the 40 to 50 mill. tons of coal wastefully burned annually in the domestic grate. A large proportion of this 'domestic coal' or 'house coal' is excellent bituminous gas coal—and the diversion to the gas industry of the saving from house coal consumption would pay at least three-fold dividends in increased coke production at the gas-works.

He then makes brief reference to coke quality. Unfortunately, he remarks, we are not in the position today that we were pre-war regarding the control and development of coke qualities for specific usages. In the last few years before the war, when a glut of coke made selling competitive, and when we had a free choice in the selection of our coals for carbonisation, excellent progress was made in the gas industry in the production of really attractive, free-burning, highly reactive cokes for the domestic market. Today the wherewithal and the incentive have been more or less taken away—and, he suggests, it must be admitted that apart from effective grading, etc., coke quality (for domestic use) is not as good as it has been. There is, he feels, one partial compensation in that the comparatively recent development of highly efficient domestic coke-burning appliances enables such coke as is available to be consumed in general much more readily and effectively than formerly.

The sales aspect of coke was effectively developed in a paper which Mr. W. J. Rawlings presented to the Scottish District (Western Area) Circle. Mr. Rawlings, who is Coke Executive Officer of the Scottish Gas Board, compares the work of the gas salesman with that of the coke salesman.

The gas salesman, he says, is dealing with a fuel of uniform quality, whereas coke quality can vary for many reasons. In the domestic market there is a prejudice against coke, people contending that it creates dust, but the real prejudice is against the fumes. It has also been said that coke had a bad effect on copper back boilers, but the copper industry, in spite of many tests, had been unable to prove that this was true. The gas salesman can concentrate on the selling of gas appliances, he continues, but the coke salesman has first of all to sell an appliance which will burn coke efficiently. When he has done that he has provided the consumer with an appliance capable of burning various types of solid fuel. He has thereafter to persuade the consumer to continue to burn gas coke and has also to see that the consumer gets coke of the right size and quality.

New Wire Brush Factory

ON January 11 the new factory of A. Luson and Sons, Ltd., at 'Gem' Works, Minerva Road, Park Royal, London, N.W.10, was formally opened by His Worship the Mayor of Acton.

The firm was established in 1874 by the father of two of the present Directors, Mr. A. J. and Mr. W. H. Luson. He started by importing a few wire flue brushes from Germany and soon afterwards began manufacturing on his own behalf. He was a pioneer in the design and manufacture of brushes for the gas industry and for the foundry trades.

The new Park Royal factory with an area of 24,000 sq. ft.

Each 'Gem' power wire rotary brush is hand-balanced during assembly for safety and economy in use.

In those days, however, wire brushes had only a limited application and it was not until the advent of the modern machine tool that the demand for them became established. The firm pioneered the design and production of the power wire rotary brush in this country and today claim to produce more wire brushes than any other firm in Europe.

For Every Trade

There are many difficulties in the way of completely mechanised production due to the demand for so many different types. The firm is today making over 500 types of brush for practically every trade, and a particular service has always been the designing and supplying of 'specials.' There are on the firm's books specifications for over 7,000 of such 'special' brushes which are supplied to every part of the world. For example, over 8,000,000 'specials' were manufactured for the Royal Navy during the last war.

The growth of the firm has been steady and continuous since its foundation and since the 1914-18 war, each year has shown, without exception, an increase in turnover and production over the preceding year. Production was trebled during the ten years 1939-49 and the period 1949 till the present day has shown a 50 per cent. increase.

Up to 1949, the business was a purely family affair, the three Directors running it themselves; one as outside representative, one as Office Manager and one as Works Manager. After the war, it became obvious that changes would have to be made if the expansion and prosperity of the company were to continue. The three Directors felt that the plans they had envisaged could only be brought to fruition by younger men who could look forward to a considerably longer business life than was left to them, for Mr. A. J. Luson is now 73, his brother Mr. W. H. is 69 and Mr. H. S. Collier is 63. Therefore, they considered the time had come to introduce younger blood and Mr. L. Rose, in his 'thirties, was appointed to the Board in charge of sales, and plans for the construction of the new factory were pushed ahead. It has an area of 24,000 sq. ft., well over twice the size of the old building in Standard Road.

Mr. L. Rose, son of Mr. A. H. Rose, is new to the brush industry. He was law lecturer at Cambridge for two years. He was called to the Bar in 1945 and practised as a barrister until 1949. He served with the Royal Tank Regiment during the war.

Mr. Rose has just flown to the United States and Canada in search of new business and will, no doubt, keep an eye open for new ideas as well.

Another step forward has been the recent purchase by the Company of the British patents of a French invention. This is a rubber bonded wire brush of revolutionary design which, under tests so far carried out, has a life three to four times as long as any other made today. This new brush has been named the 'Gem' Vulcan and all being well, will be in production later this year.

Change of Address.—The British Sulphate of Ammonia Federation, Ltd., announces that as from January 1, its registered office was transferred to Thornycroft House (South Block), Smith Square, London, S.W.1. (Tel. VIC 1953-4-5), to which all correspondence formerly directed to the secretarial and accounts department should now be addressed.

LARGE SCALE COOKING

By CHARLES H. LONGLEY,
Industrial Department, Liverpool Group, North Western Gas Board.

This paper, given to the Manchester and District Junior Association of Gas Engineers, deals with one particular application of gas in large scale cooking. It describes the installation of the gas kitchens in the Students' Union of Liverpool and gives information regarding the sizing of the equipment, the layout, and some details of the gas consumption per meal.

THE Union was opened in 1911 to supply the student community with a building in which could be held all those out-of-lecture activities which are part of University life. It was liberally planned with reading rooms, lounges, etc., including kitchen and dining room space designed to serve the students with a main mid-day meal and snacks at other times. It was originally the practice at the University for the sexes to be segregated, and the building was accordingly planned with this in view. Separate entrances were installed for both sexes with complete duplication of all facilities including separate dining rooms, although the latter were served by a common kitchen. No accurate information is available about this kitchen but it is understood to have been quite modest in size, using a combination of gas and solid fuel.

The student population at that time was approximately 800 men and 300 women.

The building, with minor alterations, remained substantially the same until 1935 when, due to the gradually increasing student population over the years 1911 to 1933 (1,100 to 2,500 students) the facilities were becoming cramped and alterations were put in hand. These were extensive and included the complete re-designing of the kitchen and dining rooms. At the same time, sex segregation was abolished thus allowing both sexes to use a common dining room. For those who wished to continue dining separately, two smaller rooms were provided. The Liverpool Corporation Electric Supply Department, as it then was, supplied and installed all the cooking and servery equipment on special simple hire terms and supplied electricity on a favourable tariff for the whole building. It should be stated that repeated efforts were made by the Liverpool Gas Company, both prior to the above installation and in subsequent years, to interest the University authorities in gas, but without any concrete results.

These conditions continued up to and including the war years, the student population fluctuating from 2,500 in 1935 to 2,600 in 1939, decreasing to an average of 1,500 during the war years.

The end of the war saw the return of those Service men whose studies had been interrupted, and this sudden increase in student population presented the University with many problems among which was that of catering. The existing Union facilities were designed for a maximum student population of 2,500, whereas the numbers now involved were 3,700. The authorities tackled this problem in the following manner.

A near-by Swedenborgian church whose congregation had dispersed during the war years was purchased and extensive building operations were put in hand to convert this building into what is now known as the Annexe, capable of easing the strain on the main Union catering services. For some months discussions had been going on between the University authorities and the Liverpool Gas Company on the advisability of substituting gas equipment for the electrical equipment in use in the main Union building, and in fact a plan and estimate had been prepared but had been shelved for financial reasons. However, it was decided to install gas equipment in the Annexe, and the following scheme, based on discussion with the Clerk of the Fabric and prepared with the co-operation of Radiation (Large Cooking Equipment) Ltd., was finally approved and installed, intending to cater for 700-800 main meals daily.

The building consists of a basement and ground floor. In the basement are contained the stores, general preparation and main kitchen. Existing rooms were adapted for storage, preparation, and supervisor's office. The basement is connected by service lifts to the servery and dining room directly above.

When designing any kitchen layout, it is essential to keep the food moving from delivery to storage and to the final service with the minimum of walking and crossing of operations—*i.e.*, a constant flow is required. To comply with this essential requirement, the cooking equipment was split into three distinct groups:—(1) Vegetable boilers; (2) island site comprising ovens, hotplates, and steamers; (3) fish fryer.

Liverpool University Dining Room Service.

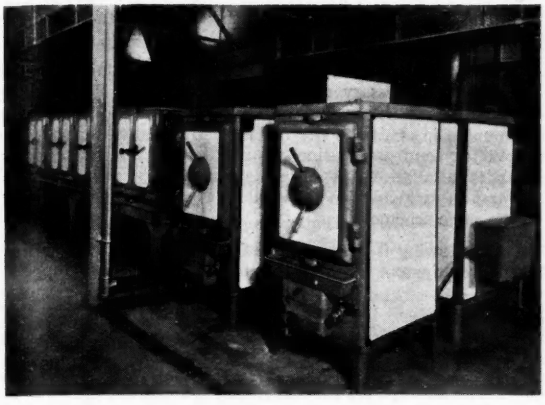
Two 100-gal. bulk storage heaters were sited for convenience beneath the wash-up and alongside the vegetable boilers.

Conveniently placed were three separate preparation bays for vegetables, pastry, and meat and fish, with all the necessary stores near at hand.

In addition to the cooking odours, it is necessary to vent the kitchen of steam and products of combustion, thus reducing condensation and giving better working conditions. In this installation, the three cooking sites are ventilated and connected by a common trunking scheme with an extractor fan. A 30-in. diameter axial flow fan capable of handling approximately 6,000 cu.ft. of air per minute against the resistance of the

ductwork was installed, and this adequately deals with the necessary ventilation.

The amount of equipment installed is based not only on the number of people dining but on the type of menu offered. A menu as offered to university students will require more equipment than that required in the average industrial canteen



View of kitchen, Liverpool University Cafeteria, showing two pairs of Chester ovens on stand and two Keswick vegetable and pudding steamers.

where a relatively simple menu is more common. This, of course, affects the gas consumption per person dining, and a kitchen offering a wide choice in menu can quite easily double the consumption figure pertaining to a kitchen supplying one set meal. Oversizing of equipment will also increase the gas consumption per person dining. On the other hand, insufficient equipment might result in a lower gas consumption but most certainly results in poor service to the diner and unnecessary inconvenience to kitchen staff. The following is therefore a guide to and an explanation of how this particular kitchen was sized.

Taking the installation section by section and examining it for size and arrangement, firstly:—(1) *Vegetable Boilers.*—Two 20-gal. Lune boilers; one 20-gal. dual purpose boiler. In calculating the size required, it is usual to allow 4 to 5 lb. root vegetables (*i.e.*, potatoes, etc.) per gal.; 2 to 3 lb. green vegetables per gal. Then allowing 6 oz. (*i.e.*, ⅜ lb.) potatoes per person, we obtain $\frac{800 \times 3}{8 \times 5}$ gal. = 60 gal. total boiler capacity.

The pans are of cast iron, bower barffed, which are preferable to copper since the latter are liable to be scratched and set up verdigris.

The time per operation is approximately 1½ to 2 hours with a gas rating of 50,000 B.Th.U. per hour per boiler.

(2) *Steamers.*—Three 4158 Keswick steamers. These are used for cooking a variety of foods including puddings root vegetable and fish and were sized as follows:—*Pudding*—Individual 3-in. dia. basins, allow 12-16 per sq. ft. Thus total capacity of steamers required in this case = $\frac{700 \text{ to } 800}{16}$ = 44 to 50 sq. ft.

Each Keswick steamer has six trays with area 2½ sq. ft. per tray (total area, 15 sq. ft.). Thus three steamers were required. An alternative method is to base the capacity on cylindrical pudding tins, allowing 24 portions per sq. ft. then $\frac{700 \text{ to } 800}{24}$ = 30 to 33 sq. ft.—say three steamers.

The appliances are of the atmospheric type to distinguish them from other types which operate at a pressure of ½ lb. per sq. in. inside the working chamber. It is generally accepted that the atmospheric type is slower than the pressure type, but cooking results are the same. The gas rating is 38,000 B.Th.U./per hour per steamer.

(3) *Pastry Oven.*—One 40/2 Confector. This appliance is rather difficult to size, due to its variety of loads, but demand for cakes can be related to baking capacity as follows:—

Smalls, such as Queen cakes: Allow 17 cakes per sq. ft. oven tray area. The appliance installed in this case has two decks, and by loading the oven with two trays (each 18 in. × 28 in.) per sole of compartment, a total tray area of 7 sq. ft. is obtained. The total oven load = 14 × 17 = 238 Queen cakes.

This particular appliance has 10 in. high compartments which permits the satisfactory baking of large pies, slab cake, etc. It allows when baking smalls for the addition of a second tray to each compartment, thus almost doubling the oven output.

(4) *Ranges.*—Four 227 Chester mounted on 24 in. cast stands. In sizing the capacity or number of ovens, the following is an accepted guide and was the basis of the above installation. The roasting capacity is estimated by allowing 8-10 lb. meat per cu.ft. oven space measured by door opening multipled by back to front inside dimension. Then, allowing 6-8 oz. per person, we obtain $\frac{700 \times 6}{10 \times 16}$ = 33 cu.ft. oven capacity. Four ovens with a total capacity of 32 cu.ft. were installed.

(5) *Boiling Table.*—One 607 Chester boiling table. Common practice is to allow for that length of boiling table which would normally span the oven top. This sizing is not exact and is varied in accordance with the amount of other specialised equipment installed—for example, vegetable boilers and steamers. In this case, a boiling table 7 ft. 6 in. long, compared with the overall width of the oven of 10 ft., was included, fitted with ring burners, which liberally supplies all that is required.

Over these items again is a glazed canopy.

(6) *Fish Fryer.*—One No. 33 Wardour fish frying range (total pan bottom area, 12 sq. ft.). This appliance, besides being used for the frying of fish and chips, is commonly used for rissoles, cheese fritters, etc. The capacity is based on fish or potatoes, thus:—

Fish.—3 to 3½ lb. fish per sq. ft. pan bottom area and ¼ lb. cod steak per person. $\frac{700 \times 2}{4 \times 7}$ = 50 sq. ft. Allow 15 min. for loading, cooking, unloading, and oil temperature recovery.

Chips.—4 to 5 lb. chipped potatoes per sq. ft. pan bottom area and 6 oz. per person. $\frac{700 \times 6}{4 \times 16}$ = 65 sq. ft. Allow 15 min. for loading, cooking, unloading, and oil temperature recovery.

Due to the difficulty of storing this type of food, it is always advisable to install a size which will give the minimum number of operations. In this case there is a 2-hour serving

The Dining Hall, Liverpool University Cafeteria, showing Bratt Colbran panel wall type heaters.

period, and as each cooking period lasts 15 min., the theoretical size of range $= \frac{115}{8} = 14$ sq. ft. Assuming, as is usual, that no more than 75% will ask for this part of the menu, a range with minimum size pan area of $\frac{75 \times 14}{100} = 10.5$ sq. ft. is required. To cut down the time period and leave something in hand, 12 sq. ft. was installed.

It is recommended that this type of equipment should be thermostatically controlled, and above all, it should be included in the ventilation scheme. To reduce the risk of fire in the trunking of the canopy, a fusible link, operating a butterfly damper, was included.

An 8 ft. × 2 ft. 6 in. Belgravia hotcloset with bain marie and carving well was installed to help the flow of food from kitchen-lift-service. It is equipped with water well and carving dishes.

Water Heaters.—Two 100-gal. bulk water heaters. The sizing depends on many factors. A rough figure is to allow one-third gal. per person. As stated, two 100-gal. cylinders were installed, one supplying the kitchen and preparation bays and the other the wash-up and dishwasher on the floor above. The unit (thermal efficiency, 65%) has been proved adequate in all respects.

The café set is a Stott No. 2 Regula, the middle unit being the boiler with an output of 7 pints of boiling water per min., the two side units being 1 gal. urns for the storage of milk and coffee. A rough guide in sizing this appliance is to allow approximately one-third pint per person dining.

By the service hatch is fitted a 36 in. double compartment griller which provides for toast and is used for the quick heating up (prior to serving) of any special dishes, etc.

The heating scheme for the dining room consists of eight Bratt Colbran luminous panel overhead heaters and three 2-column Cannon Beacon radiators. This has proved very satisfactory.

While the Annexe scheme was being discussed, an opportunity was taken of submitting a price for the replacement by gas of the electrical equipment in the main Union kitchen. However, due to the heavy capital commitments involved with the Annexe, the matter was shelved at the time. With the passage of the years, however, the success of the Annexe installation led to the replacement item for item of all the electrical cooking equipment in the main Union kitchen, with the exception of those items which the University had bought in recent years. The kitchen capacity was slightly increased, as also were the service arrangements. The customer's own electrical appliances were incorporated in the new scheme, including the hot water supply which was by electric immersion heating.

The kitchen is on the top (3rd) floor of the Union together with all the necessary stores and preparation. The cooking equipment, with the exception of a 3-pan fryer and pastry oven, is mounted in an island site in the centre of the kitchen. This allows for food preparation around the site and makes for a compact installation. A glazed canopy is fitted over the island site and an extractor fan is installed; the fish fryer is ventilated by the same scheme.

The following is a summary of the gas equipment and the electric equipment it replaced, together with the respective ratings:—

KITCHEN

Electric Appliance	Loading kW	Rating (B.Th.U. per hour)	Gas Appliance	Rating (B.Th.U per hour).
3-pan fish fryer	24	81,888	3-pan fish fryer	270,000
Double comp. steamer	10	34,120	Double compartment steamer	76,000
9 ft. 8 in. boiling table	30	102,360	Single compartment steamer	38,000
3 ft. 2 in. boiling table	7.5	25,590	12 ft. 6 in. boiling table	47,000
3-oven range	15	51,180	4-oven elev. range	107,000
8 ft. × 2 ft. 6 in. hotcupboard*	9.6	32,755	8 ft. × 2 ft. 6 in. hotcupboard with bain marie	33,600
Two 20 gal. boilers	15	51,180	Two 20 gal. veg. boilers	100,000
One 20 gal. dual purpose boiler	7.5	25,590	Two 20 gal. dual purpose boilers	100,000
Pastry oven	20	68,240	Pastry oven	75,000
TOTALS		472,903		846,600

* Incorporated in new scheme.

The hot section consists of a 14 ft. 6 in. × 2 ft. 6 in. service counter with all necessary dishes. The counter top is so designed that all the dishes are interchangeable, which is an improvement on the Annexe counter. Mounted behind the counter is a 36 in. 'C' Pattern griller, being an improved design on the 'B' type, as installed in the Annexe. Fitted at the end of the counter is a Stott 2A Regula cafe set supplying the necessary beverages for this section.

HOT SECTION

Electric Appliance	Loading kW	Rating (B.Th.U. per hour)	Gas Appliance	Rating (B.Th.U. per hour)
2 ft. 6 in. × 2 ft. 6 in. bain marie	5	17,060	2 ft. 6 in. × 2 ft. 6 in. bain marie	28,200
8 ft. × 2 ft. 6 in. hot cupboard	12	32,755	8 ft. × 2 ft. 6 in. hotcupboard and bain marie	140,000
4 ft. × 2 ft. 6 in. hot cupboard*	5	17,067	4 ft. × 2 ft. 6 in. hotcupboard	12,000
Bartlett cafe set	...	72,000	Stott No. 2 Regula cafe set	84,500
2-tier griller	10	43,120	36 in. 'C' Pattern griller	20,000
TOTALS		173,042		284,700

* Incorporated in new scheme.

Dining Room Servery.—This consists of a 16 ft. 6 in. × 2 ft. 6 in. service counter with interchangeable dishes, and tray rail. Fitted at the end is a Stott Regula cafe set for beverages. Also fitted is a 36 in. 'C' Pattern griller, alongside of which is one of the customer's own electric hot-cupboards.

DINING ROOM SERVERY

Electric Appliance	Loading kW	Rating (B.Th.U. per hour)	Gas Appliance	Rating (B.Th.U) per hour.
2 ft. 6 in. × 2 ft. 6 in. bain marie	5	17,060	8 ft. × 2 ft. 6 in. hotcupboard and bain marie	140,000
8 ft. × 2 ft. 6 in. hotcupboard	9.6	32,755	4 ft. × 2 ft. 6 in. hotcupboard	12,000
6 ft. × 2 ft. 6 in. hotcupboard*	5.6	19,107	36 in. 'C' Pattern griller	75,200
2-tier griller	10	34,120	Stott Regula cafe set	84,500
Stott Senior cafe set	...	72,000		
TOTALS		175,042		311,700

* Incorporated in new scheme.

The table on p. 237 gives an analysis of tests, taken over a period of five days, at the Annexe and the Students' Union kitchens.

Season, winter; period of observation, 8.30 a.m. to 5.45 p.m. each day; hours of serving cooked meals, 12 noon to 2 p.m. No space heating appliances were in use during any of these tests.

(*Continued on p. 237*)

GAS CONSUMPTION TESTS

	Annexe		Union		
	Test 1	Test 2	Test 3	Test 4	Test 5
No. of cooked meals served	402	384	740	690	690
No. of beverages served	124	144	370	405	256
Total gas used, cu. ft. (C.V. 450)	6,270	5,890	7,023	6,985	6,695
Analysis of consumption (cu. ft.):—					
Water heating	2,725	1,885	—	—	—
Cooking, including service	3,378	3,837	6,672	6,640	6,355
Beverages	167	168	351	345	340
(A) Average cons. (cu. ft.) per cooked meal	8.4	9.9	9.02	9.62	9.21
(B) " " " per beverage	1.35	1.7	0.949	0.852	1.328
(C) " " " per person hot water	6.80	4.9	—	—	—
*(D) " " " per person dining	15.6	15.3	9.5	10.1	9.7

$$D = \frac{\text{Total gas used in cu. ft.}}{\text{No. of persons dining}}$$

The average consumption (cu.ft.) per person dining in the Annexe should be related to the large variety of dishes offered on the menu and to the fact that the installation was designed to cook and serve 700 main meals, whereas the average daily throughput approximates to only 400. It is considered that if the choice were limited to one set meal and full capacity of equipment utilised, the average consumption could be reduced by as much as 30% to 40%.

The lower consumption figure obtained on the second day is the result of economy of water usage practiced by the manageress and obtained by reducing the working time of the storage set by approximately 50%. Although a lower average water consumption was obtained on the second day, the average consumption per diner remains approximately the same due to a higher average consumption per cooked meal. This latter was due to the appearance on the menu of fish and chips and the high consumption of gas needed for their preparation.

The difference in figures between the Annexe and the Students' Union in Section 'D' is attributed to the fact that gas is not used for hot water supply in the latter.

The lower beverage consumption figure (Section 'B') obtained in the Students' Union is due to the higher number of beverages served.

DISCUSSION

The **President** (Mr. L. G. Townsend, Liverpool) remarked that the B.Th.U. rating of the various gas appliances was in each case greater than that of the electrical appliances which they replaced.

Mr. W. L. Howe (Liverpool Group Industrial Sales Engineer), who acknowledged the presence at the meeting of Mr. R. J. Haugh (District Service Manager, Bolton-Westhoughton), suggested that the paper could be considered as a joint effort, Mr. Haugh being responsible for the installation and Mr. Longley for a factual analysis and report on the subsequent performance of the equipment. The changing of habits of the University students in regard to catering, continued Mr. Howe, illustrated the necessity for industrial gas engineers to maintain an open mind in assessing the requirements of various processes and to adjust their recommendations accordingly. He knew it had been the author's original intention to present comparative figures for electricity and gas used for the same process and performing the same duty, since such figures were rarely obtainable, but he appreciated the reasons which had prevented their publication. He suggested that Mr. Longley might comment on the factors which, in his experience, were involved in such a comparison, since relative costs were not the sole criterion. Mr. Howe also mentioned the question of good appearance of equipment, and expressed the wish that manufacturers of furnace equipment would recognise the importance of this fact to the same extent as those who supplied the industry with canteen appliances.

Mr. Longley, in his reply, listed certain factors involved in any gas and electricity comparison. More maintenance was required with electrical equipment than was needed with gas, and electric current was wasted due to lack of visual aids. Running costs of a gas installation were less than an electric installation. Again, it was easier to obtain canteen staff with experience of gas equipment than it was to obtain staff with experience of electricity. Generally, the capital cost of gas equipment was less than its electrical counterpart, and there was greater flexibility of control with gas.

Mr. H. C. Jackson (Group Sales and Service Officer, North Cheshire) said that the Liverpol group was fortunate in having specially qualified and trained personnel available to handle such installations. He referred in detail to various aspects of the scheme embodied in the paper, stressing the requirements at each stage with particular reference to heating, lighting, ventilation, drainage, plumbing, etc., and remarked on the post-war improvement in the operating efficiency of large scale catering apparatus. He thought, however, that there was still scope for further improvement in design and thermal efficiency. He also asked the author whether any maintenance scheme operated in the Liverpool area or whether they favoured the training of consumers' own personnel for this duty. He also enquired to what extent the home service staff at Liverpool were used in connection with demonstrations in industrial and commercial catering establishments.

Mr. Longley replied that an efficient maintenance scheme operated in Liverpool and, on the completion of every installation, a maintenance contract was offered to the customer. In regard to the home service organisation, up to the present this had had very little contact with the customers referred to by Mr. Jackson.

Mr. J. Oates (Oldham-Rochdale Group) said that recent published figures indicated that the percentage of meals consumed away from home was approximately 18%, and that about 55% of the total school population had their dinners at school. The growth of industrial canteens and communal feeding throughout the country was not only important from the point of view of gas load, but such well-designed kitchens and service as had been described by Mr. Longley did much to enhance the prestige of the gas industry. Mr. Oates considered that too much importance was usually paid to the factor of 'amount of equipment for a given number of people.' He usually found that the suggested equipment was based on the minimum capacity required; and while agreeing with Mr. Longley's method of assessment, he personally would use the maximum figures. For one canteen catering for 300 people; he gave a figure of 13 cu.ft. per person for all services, which included 4 cu.ft. per person for hot water only. For an hotel catering for 60 people, the total consumption was 26 cu.ft. per person—*i.e.*, exactly double, indicating the important factor of the different types of service required, the different type of menu offered, and the size of portion served.

Mr. Oates pointed to the importance of the hot water load. He considered that the hot water requirements in catering establishments had nearly doubled during the past 10 years—probably due to the efforts of the public health authorities, resulting in increasing numbers of dish-washers and sterilising sinks being used. He criticised the equipping of some kitchens by various authorities supplying equipment from a central pool. He had had experience of kitchens equipped with both gas and electric appliances, and in some instances solid fuel, supplied because they just happened to be available and installed without due regard to the factors dealt with by Mr. Longley. In some cases, the gas equipment compared very unfavourably with the more modern electric equipment supplied.

Mr. R. J. Haugh pointed out that no regional organisation appeared to be available for training and educating industrial engineers, though no doubt this was being discussed in the proper quarters. He suggested that the system in operation at Liverpool was a good one and that it might well be applied over a wider area. At Liverpool each industrial representative was responsible for maintaining his own customer contacts and for following through enquiries received, thus ensuring that proper service was given. While in fact each industrial assistant specialised to some extent, all members of the Industrial Department were so trained that they could deal with an enquiry in any field of sales. He stressed that the installations at the Students' Union were sold on the basis of 'better service at lower cost.'

Mr. Hooper (St. Helens) proposed and **Mr. J. F. Smith** (Fylde group) seconded a vote of thanks to the author.

ECONOMICS OF GAS PRODUCTION

The following is an abstract of a paper given by T. Nicklin, M.Sc., M.Inst.Gas E., A.M.I.Chem.E., Production Engineer, and M. Redman, B.Sc.(Tech.), A.R.I.C., Assoc.M.Inst.Gas E., A.M.I.Chem.E., Assistant Production Engineer, North Western Gas Board, to the Manchester and District Section of the Institution of Gas Engineers. Our report of the discussion is also published.

THE factors which influence the cost of gas into holder are (a) those which are influenced by operating results over which we have a degree of control; (b) those over which we have little control—capital and raw material costs. Considerable increases in cost of coal, capital cost of new plant and replacements, and labour have taken place in the past 10 years. Capital cost has now a pronounced effect on cost of gas into holder. The new cost of coal (coal less residuals) has more than doubled, but the differential between costs of coal and coke is generally the same as 10 years ago. The effect of the cost of capital and labour can be minimised by ensuring that the maximum thermal output is obtained from the plant. There is a school of thought which believes that everything will be well with the balance-sheet if a high level of 'therms per ton' is maintained. This is fallacious if 'therms per ton' is maintained by operating plant below its rated throughput.

Items of Total Cost

The paper endeavours to indicate the significance of the several items contributing to the total manufacturing cost of gas and the effect on it of various methods of operating various plants. The effect of the purchase of electricity and water will be considered and the case for 'home' power generation from waste heat and the use of cooling systems for condenser and other water is presented.

'The manufacture of gas in central production stations such as coke ovens will be shown to be the most economic method of manufacture, and the effect on the cost of gas delivered by reducing the output from the coke oven battery will be shown to be less pronounced than in the case of normally accepted gas-making units.'

Recently, with the advent of the petroleum chemical industry, considerable quantities of 'tail gases' (propane, butane, and other hydrocarbon gases), with calorific value between 1,000 and 1,500 B.Th.U. per cu.ft., have become available. The 'bleeding' away of tail gases to atmosphere should not be allowed; they should be used in the gas industry. The economics of propane-air mixtures for gas supply to outlying districts and small communities is discussed in comparison with the manufacture of gas in small units and with the supply of gas in bulk from central stations. The catalytic gasification of heavy oil to produce gas with town gas characteristics is also considered.

The relative costs on three standard forms of plant—horizontal, continuous vertical, and intermittent vertical retorts—are reviewed, together with the effect of dilution with water gas and producer gas on the cost of manufacture in these plants and in coke ovens. To ensure that the figures are strictly comparative, new plant on virgin site is assumed; some 200 hypothetical combinations at several capacities have been considered.

Basic Data: The following data have been assumed in the calculations:—An average depreciation of all plant over 25 years has been adopted in preference to different rates for each individual item of plant.

Scurfing is taken at 2½% for intermittent vertical retorts and horizontal retorts, 7½% for continuous vertical retorts. Coke breeze under ¼ in. is taken at 10% of coke ex retorts when steaming down to 450 B.Th.U. per cu.ft., 9% to 475, 8% to 500 and over—8% for horizontal retorts.

No waste heat recovery is assumed for horizontal retorts below 1 mill. cu.ft. per day and for verticals below ½ mill. cu.ft. per day.

In continuous vertical retorts over 3 mill. per day it is assumed that steam and electricity requirements will be fully met from waste heat recovery; the same applies to intermittent verticals and horizontals of 6 mill. per day and over.

Coal carbonised is assumed to be Yorkshire and Lancashire screened.

Working Results

These are based on West's No. 3 Steaming Curve for C.V.R., 'modified for normal practice in the case of intermittent vertical chambers.' Gas yields refer to purified gas after admission of 4% of air. The working results with Yorkshire and Lancashire coals (Table 1) are assumed.

Supervision of carbonising plant is assessed at one technical assistant for each bench of 3 mill. cu.ft. per day or less.

'The costs have been calculated as costs "out of holder" rather than "into holder" . . . holder capacity and operation are included to the extent of . . . a six hour holder at maximum production rate.'

Coal price is taken at 67s. 6d. per ton; coke, 75s.; breeze 20s. These prices represent average conditions in the area of the North Western Gas Board.

'It should be noted that the above carbonising results represent those which should be easily attained on average coals.'

For producer gas 0.119 cwt. dry coke per 1,000 cu.ft. is assumed.

TABLE 1.

Calorific values	Continuous Verticals				Intermittent Verticals				Horizontals	
	425	450	475	500	450	475	500	550	550	Machine Charged 550
Therms per ton ...	101.8	89.8	81.4	75.3	89.0	82.7	78.5	71.0	63	65
Make per ton, cu. ft. ...	23,950	19,960	17,150	15,100	19,800	17,420	15,700	12,900	11,450	11,820
Tar per ton, gal. ...	17	16	15	14	12	12	12	12	12	12
% Steaming	35.0	24.5	17	11.5	24.5	17.5	12.2	4.0	—	—
Dry coke discharged, cwt.	11.8	12.35	12.75	13.05	12.58	12.89	13.13	13.5	13.5	13.5

For blue water gas in external plant 0.344 cwt. per 1,000 cu.ft. (later in the paper 37.5 (=0.335 cwt.) is assumed).

Repairs and maintenance including labour and materials are assessed at 7d. per 1,000 cu.ft. for works of 100,000 cu.ft. per day, falling to 3.5d. for works of 5 mill. cu.ft. per day and upwards.

Producer fuel consumption has been assessed on the basis of actual results on well-operated plants and is confirmed by contractors' guarantee figures.

Steam to producers: 40% of weight of coke for C.V.R., 60% for I.V.R.

Steam consumption for concentrated liquor plant and surplus steam available from water gas plants is allowed for.

Waste heat steam produced: 2.0 lb. per lb. of fuel for horizontal, 3.0 lb. for intermittent verticals and 4.75 lb. for continuous verticals—all 'from and at 212°F.'

Power, Water, and Labour

Power is assumed to be generated by engine-driven sets from waste heat steam on 'horizontal' works of 3 to 6 mill. per day, by turbines on larger works, and by turbines on 'vertical' works from 3 mill. and upwards. No charges are therefore made for steam or electricity for continuous verticals of 3 mill. capacity and upwards and for horizontals for 6 mill. and upwards. 200 kWh per mill. cu.ft. per day is assumed excluding retort house coal and coke handling. Power for retort-house and coal and coke handling is assumed to be 4 kWh per ton of coal carbonised for continuous verticals and horizontals, and 4½ kWh for intermittent verticals. Power for water gas plant is taken at 0.5 kWh per 1,000 cu.ft. of blue water gas. Compression is not included on any of the works.

Water requirements are assessed on the assumption that cooling towers are installed with make-up 6% of the cooling water requirements. For intermittent vertical and horizontal coke quenching make-up is taken at 100 gal. per ton of coke quenched; for continuous verticals 20 gal. per ton of coke, assuming that the bottom spray water is recirculated.

Labour for carburetted water gas is taken at two men per shift per unit, and three men per shift for two automatic units. Labour for retorts, top and bottom of the settings, producers, waste heat boilers, coal and coke handling, cleaners, scurfers, etc., but excluding technical and chemical supervision, foremen, and maintenance men, is set out in a table for daily capacities of 500 to 100,000 therms. A representative line, for 10,000 therms per day, 2 mill. cu.ft. at 500, is continuous verticals 17, intermittent verticals 17, horizontals 18, yard labour 12, men per day. The figures do not include reliefs which are taken into account on the basis of seven men for six.

Plant Sizes

All figures are assessed on the basis of the same thermal output from each type of plant. In the case of continuous verticals this is affected by the size of coal carbonised. 'Screened coal' has been assumed as being more representative of coal sizes now obtainable 'than the larger coal of nut size for which the continuous vertical retort is more particularly suited'; the number of retorts required is greater for the former than for the latter to obtain the same thermal output.

Calculated costs are tabulated for plant of 500, 1,250, 2,500, 5,000, 10,000, 30,000, 50,000, 75,000 and 100,000 therms capacity per day when making gas in horizontals at 550 B.Th.U. per cu.ft. diluted by blue water gas or producer gas to 425, 450, 475, and 500 B.Th.U. per cu.ft.; in intermittent vertical chambers diluted to 425, diluted or steamed down to 450, 475, and 500; in continuous verticals steamed or diluted with blue water gas to 425, steamed or diluted at 450 and 475, and 'straight' at 500 B.Th.U.

Gas at less than 425 is not considered because of the cost of relaying distributing systems and the capital restriction on such expenditure. The upper limit is fixed at 500 because with continuous verticals thermal output per unit of plant falls above that value, because coals such as Notts. and Derby will not easily make gas of higher calorific value and 'again, there is a greater increase in thermal loss due to refractory porosity. . . .'

A calorific value of 425 is justified because of the low cost of dilution plant compared with that of carbonising plant. For example, the capital cost of base load blue water gas plant is 0.67d. per therm compared with 1.5d. to 1.6d. per therm for equivalent carbonising plant; that of producer gas plant is about 0.2d. to 0.3d. per therm.

The influence of plant size is shown on graphs, one for base load working and one for a manufacturing load factor of 280 days, which is the average for the North Western area. The definition of load factor on manufacturing plant is the ratio, 'gas made per annum/gas made per maximum week × 52¼.' This assumes that distribution will carry adequate storage to even out the peak week—*i.e.*, seven maximum production days are considered to occur in a maximum week. Thus the manufacturing load factor differs from the distribution load factor, which is the ratio—gas sent out per annum/gas sent out per maximum day × 365.

The Economic Aspect

It is shown that:—

(i) The most economic unit with all types of plant and under all conditions of operation is the largest one.

(ii) Under base load conditions the cheapest gas is made in intermittent verticals operated at 550 B.Th.U. diluted to 500 with producer gas. The cheapest gas at all calorific values is produced by dilution of gas at high calorific value diluted with producer gas; but specific gravity considerations limit dilution to the minimum of 450.

Operating on load factor 280 maximum days the cheapest gas is still made in intermittent verticals diluted with producer gas, but at 500 there is a plant size at which horizontals produce a cheaper gas owing to reduced capital charges.

(iii) For small units, the horizontal with producer gas dilution is shown in all cases to make the cheapest gas owing to low capital charges.

(iv) The cheapest gas is made with all types of plant by making at high calorific value and diluting with producer gas to the declared value.

(v) The horizontal is less affected by reducing load factor than any other type of retort, due to the lower capital charges.

(vi) *Blue water gas dilution with continuous verticals:* On base load for a declared value of 425 the cheapest gas is made by steaming down provided that 103 therms per ton can be obtained. The same applies to 450 gas up to a limiting unit size of 25,000 therms, above which it is cheapest to dilute externally. At 475 it is always less economical to dilute externally than to steam. On variable load it is cheaper to steam down for all sizes; at 450 it is always cheaper to dilute externally; at 475 it is again cheaper to steam down; capital charges are the determining factor at 450 and 475.

With intermittent verticals: On base load at all calorific values and in all sizes of plant external dilution makes the cheapest gas. On variable load in units up to 60,000 therms the cheapest gas at 425 is produced with external dilution. As the declared calorific value increases some advantage is lost because the high price of coke outweighs capital cost of increasing carbonising plant to make up the thermal output.

With horizontals (with the two exceptions of plant under 75,000 therms per day at 500 and under 60,000 therms at 425, both on variable load) dilution with blue water gas produces the next dearest gas to that obtained by steaming intermittent verticals; it is concluded that horizontal retort gas should be diluted with producer gas.

(vii) *Economics of Producer Gas Dilution:* This is not considered for a calorific value of 425 because the mixture would have too high a specific gravity. On base load with producer gas dilution the cheapest gas at 450 and 475 is made in continuous verticals in all sizes of plant except the very small. At a calorific value of 500 intermittent verticals with producer gas dilution produce the cheapest gas. On variable load at 450 and 475 the cheapest gas is made in intermittent verticals with producer gas dilution; at 500 it is the same in plant sizes above 60,000 therms per day. Below this size, gas from horizontals with producer gas dilution is the cheapest. 'It is significant to note that gas produced in continuous verticals at 500 is always dearer than producer-gas-diluted horizontal retort or intermittent vertical chamber gas.'

From the graphs 'the very important conclusion' is drawn that the dilution of high calorific value gas with producer gas produces the cheapest gas at all declared calorific values. It

is inferred that the continuous vertical retort is the 'least amenable to work on part load' and that load variations are most easily taken on the horizontals.

It is noted, too, that the cost of gas is still on the decline as plant sizes increase to 100,000 therms per day, but it is considered that units greater than 50,000 or 75,000 therms per day would be difficult to manage with the maintenance of a high standard of efficiency.

The effect of declared calorific value on cost of gas in various sizes of plant is graphed. The graphs show that in continuous verticals the cheapest gas is made at the upper limit, 500 B.Th.U.; that this is the same in intermittent verticals diluted with producer gas except in unit sizes up to 5,000 therms per day where it is cheapest at 450 or 475; that in intermittent verticals with steaming the cheapest gas is made at 500 in all sizes of plant; that with external blue water gas dilution where unit size is sufficient to permit an economic size of water gas plant, the cheapest gas is made at 500 in all sizes of plant. At 500 the horizontal retort is similar to the intermittent verticals except in the very small plants.

Type of Plant and Method of Operation

In all sizes of plant at a declared value of 425 with external blue water gas dilution this is the most costly gas, except in the intermittent vertical chamber.

Where producer gas dilution is employed, the cheapest gas is obtained with no significant advantage of intermittent over continuous verticals or *vice versa*, and the declared calorific value has little effect on cost of gas from a unit size of 50,000 therms per day and over; 'the difference is only of the order of 0.1d. per therm.' There is a much greater divergence when blue water gas is employed and when steaming down. 'It is therefore apparent that producer gas dilution has the added advantage of greater resilience to the effect of coal and coke prices.'

The economic calorific value is not materially increased by load factor.

The very high cost of gas in the smaller units is noted. 'It can be concluded that no new works should be installed of a size less than 30,000 therms per day; the difference in the cost of gas out of holder between this and a 10,000 therm unit is some 1.3d. per therm'—more than the cost of transmission in bulk unless long distances and low load density en route are involved.

There is a very definite advantage in distribution of a high calorific value gas. In a new grid system 500 gas is distributed at about 0.1d. per therm less than a 450 gas; in local distribution the difference in a new system is 0.2d. per therm.

The effects of variation in coal and coke prices on the economic calorific value are graphed for plants of 5,000 and 50,000 therms per day capacity, with two basic coal prices of 65s. and 75s. per ton and coke ranging from 60s. to 85s. per ton working on base load.

In the large unit, until the selling price of coke is less than the coal price the cheapest gas is made at 500 with producer gas dilution. When the coke price is less than coal cost, the cheapest gas is made at a lower calorific value in horizontals and intermittent verticals with blue water gas dilution and by steaming down in continuous verticals provided the results indicated in West's steaming curves can be obtained. It is important to note that 450 is never the most economical value for any coal or coke price or method of operation. As coke price increases over coal cost the advantage of 500 c.v. becomes more marked.

In the small unit it is noted that using coal at 65s. per ton the horizontal gives the cheapest gas for any given coke price. Intermittents with either producer gas dilution or steaming down and continuous vertical with producer gas dilution show a minimum cost of gas at 475.

In any group where there are a number of units about 5,000 therms per day and where the carbonising plant is continuous verticals the economic calorific value is 475; this figure maintains the lowest cost of gas out of holder for all coke and coal prices when producer gas dilution of high calorific value coal gas is practised. In large units the economic calorific value is 500 and therefore in an integrated system this value should, in general, be chosen.

Relative Merits of Carbonising Plant

'The sensitivity of the (continuous) vertical retort to a variation in coal size leads us to the conclusion that the intermittent vertical chamber and horizontal retort should be installed in preference to the continuous vertical retort when regard is paid to the present shortage of the larger sizes of graded coal and the increasing availability of washed slacks produced by modern coal cutting methods.' The further disadvantage of the dependence of the continuous vertical retort on 'first class top rodding' is pointed out. The coke oven is preferred to the horizontal retort because it carbonises a much larger charge thus reducing capital cost and ground space per unit of production, 'and in view of the low producer fuel consumption . . . brought about by the use of regeneration rather than recuperation.'

Experience has shown that the most economic size of coke oven plant is that which carbonises 1,100 to 1,200 tons of coal per day, producing 15 mill. cu.ft. of gas per day when fired by producer gas. 'By employing compound ovens where firing may be changed over to coal gas on any desired number of walls, it is possible to vary the coal gas available for sale down to 55% of the maximum when all producer gas firing is practised.' It is essential to operate a coke oven battery under base load conditions.

The costs of coke oven gas in batteries of 1,200 and 2,400 tons per day with producer gas and water gas dilution to 500, 475, 450, and 425 B.Th.U. per cu.ft. and with varying degrees of producer gas and coal gas firing are tabulated. It is noted that the variation in cost is not more than 1½d. therm and that as a whole the cost of coke oven gas is 0.5d. per therm less than that of gas produced in the most economical gasworks plant.

Influence of Consumer Density

It is concluded that situated in a district of high density consumption a coke oven plant can deliver gas through an average grid into station holders cheaper than it could be manufactured in smaller works near the point of demand; and where consumer density is not great coke oven gas can be distributed over a wider area. With the appropriate coal the coke oven can be operated to produce coke of either metallurgical quality or similar to that produced in intermittent verticals.

An increase of 1 therm per ton of 550 gas made in horizontal retorts will result in a decrease of 1.5% in the cost of gas. 'It is apparent therefore that the figures given and the interpreted results cannot be taken as rigid to within 0.10d. per therm. Care should therefore be taken that no dogmatic preference is formed for a carbonising plant or method of operation' where there is no more difference than 0.10d. per therm. 'Of course, other considerations such as local amenities or planning regulations can influence the choice of plant.'

A most important point concerning continuous verticals is that coals now being supplied are becoming less amenable to steaming. It is therefore not recommended under present day conditions unless it is operated with minimum steaming to produce the highest calorific value gas without losing thermal output—*viz.*, 500 B.Th.U. Failure to realise the figures given in the basic data will involve the heavy penalty of an increased cost out of holder of up to 1d. per therm, or even more if steaming down to 450 B.Th.U. is practised.

Net cost of coal represents from 40% on the smaller units to 63% on the larger of the total cost of gas. Capital cost represents from 35% on the smaller to 17% on the larger units. Management, insurance, purification, water, and electricity have little effect. Labour represents between 10 and 12%

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on the small units and 5% on the larger units. Reduction in the quantity of coke for sale due to waste or inefficiency to the extent of 1 cwt. per ton of coal carbonised will increase the cost of gas by between 0.4d. and 0.7d. per therm.

Appendix II shows the saving effected by a water cooling tower in the 50,000 therm horizontal plant. Appendix III indicates the saving effected by the 'home' generation of electricity on a works of 30,000 therms per day with continuous vertical retorts.

The third section of the paper is an assessment of production costs of water gas, based on the data: Price of gas oil 13¼d. per gal., coke per 1,000 cu.ft. 35 lb., coke price delivered to C.W.G. bunker 78s. Costs are graphed in various sizes of automatic sets operating under varying loads up to base load, reckoned at 330 days to allow for relining of generators, etc. It is noted that costs in a 1 mill. per day unit working 280 days per annum at a calorific value of 500 is 9.5d. per therm and at 450 9.25d. per therm compared with 9d. at both values for any of the three types of carbonising plant of equivalent capacity. Blue water gas of calorific value 290 B.Th.U. based on 37.5 lb. coke per 1,000 cu.ft. gas works out at 5.815d. per therm net cost into holder without labour or capital charges; in a 1 mill. plant these appear to be 0.68d. and 2.19d. respectively, giving a total cost of about 8.7d. per therm.

In the fourth section the cost of producer gas is calculated, manufactured in hand-clinkered step grate producers at 125 B.Th.U. and 13.3 lb. coke per 1,000 cu.ft. Net cost works out at 5.03d. per therm plus (for a 1 mill. plant working 250 days) 0.102d. for labour and 0.363d. for capital—total about 5.5d. per therm.

Water Gas and Carbonising Plant

In the fifth section the economics of the combination of water gas with carbonising plant is discussed. Two sizes of unit are considered, 10,000 and 100,000 therms per day each operating to meet a load factor of 285 and 275 days respectively as representing (a) a good load factor with a fair proportion of industrial gas and (b) a medium load factor as in a mainly domestic district. The results are graphed. Three ways of dealing with load variation are considered: (1) Hawthorn's method (*Gas Journal* February 22, 1950, p. 468) in which the carbonising plant is designed to meet the demand in the minimum winter week and operated on base load, the balance being made up by C.W.G.; (2) carbonising capacity to cover the maximum week with C.W.G. make up during resetting when 25% of the plant is assumed to be off for 26 weeks; (3) carbonising plant big enough to meet all demands.

With the first method, calculations show that the water gas plant works for 172.5 maximum days. To meet a load of 100,000 therms per day or 700,000 therms per maximum week, the capacities of carbonising and C.W.G. plants are 75,000 therms and 8 mill. cp.ft. per day respectively. The cost of the 500 B.Th.U. gas made in the former averages 7.3d. per therm and in the latter 9d., making an overall average of 7.84d. per therm.

With the second method, the load factor of the coal gas plant is shown to be 283.5 maximum days and of the C.W.G. plant 17, with costs 7.55d. and 19.1d. and an average overall of 7.57d. per therm.

With the third method, all load met by coal gas, costs are tabulated at 450 and 500 in the three types of plant, ranging from a minimum of 7.74d. per therm in intermittent verticals at 500 to a maximum of 7.92d. in horizontals at 450 in the 100,000 therm per day units at the load factor of 285 maximum days per annum. At 275 maximum days the figures are a very little higher.

The results of the calculations for all three methods are tabulated together. Method (2) is shown to produce the cheapest gas at either of the two values, but the cheaper of these is at 500 B.Th.U. per cu.ft. 'It is interesting to note that it is more economical to meet the whole of the load (in the 100,000 therm unit) by coal gas at a calorific value of 500, than by C.W.G. and coal gas as per Hawthorn.' The reverse is shown when operating at 450.

Section 6 is devoted to a brief consideration of the use of oil refinery gases. These 'tail' gases are a mixture of methane, ethane, propane, and butane with hydrogen in varying proportions dependent on the refinery process; they have calorific values between 1,000 and 1,500 B.Th.U. They may be used for enriching water gas or producer gas, or they may be 'reformed' to a lower calorific value which may be the declared value. One volume of a tail gas at 1,250 B.Th.U. per cu.ft. will enrich five volumes of blue water gas or 2½ volumes of producer gas to produce a mixture at 450. Reforming may be thermal. Two methods of cracking, autothermic catalytic and pyrolytic, have been described. Reforming in an ordinary vertical retort is possible, but is considered to be uneconomic. It is felt that the most economic method of using refinery gas it by means of dilution with producer gas, the extent being limited by considerations of specific gravity rather than by combustion characteristics.

The maximum volume of finished town gas, however, is produced by water gas dilution and this is recommended as the most economic and convenient when all factors are taken into consideration.

Refinery Gas Price

The price that can be paid for refinery gases is influenced by the fact that it must be accepted at a constant rate—'under base load conditions at all times'—thus reducing the load factor on carbonising plant and increasing the cost of coal gas made. The price of refinery gas must be fixed on 'the presumption that the costs of gas from all sources, combined in proportion to the quantity made, should be equivalent at most to the present average price.'

The use of liquid petroleum gas/air mixtures is briefly discussed in Section 7. The high cost of manufacture in small gasworks, 500-1,000 therms per day, and the nature of the plant employed, hand charged stop-end horizontals in which it is very difficult to maintain a constant calorific value and for which it is difficult to get labour, makes the use of propane and propane-butane mixtures an attractive proposition. With the spread of oil refining in this country these gases are becoming available to an extent comparable with that on the Continent where these gases, either alone or pre-mixed with air have been used for some years, replacing coal gas for supply to small rural communities.

Section 8 deals, also briefly, with the production from heavy oils of gas with characteristics comparable with those of town gas. Processes are available for the catalytic production of fuel gases from oil and water. The cost of materials for the production of town gas from heavy fuel at 8½d. per gal. would be of the order of 6d. per therm. Capital and operating charges are low and it is considered that the overall cost would compare favourably with that of coal gas and that the process could economically replace carburetted water gas for meeting peak loads.

The Mechanical Producer

There are three appendices. The first deals with the economics of the mechanical producer. It is not considered that the mechanical producer is economically justified unless it can use a cheaper fuel, such as breeze less than ¾ in. or ½ in., than its competitors. Two examples are worked out in detail. The annual cost of heating 20 settings of horizontals in 10's, fuel, power, repairs and maintenance, capital charges, but excluding water and labour (this is assumed to be the same in each case 'as mechanicals require poking') works out at £65,148 for mechanical using coke and breeze as against £49,702 for step grate producers using run-of-retort coke. Parallel figures for verticals are £51,474 and £46,037 respectively. The basic price, run-of-retort coke is taken at 70s. 6d. per ton and it is concluded that unless there is a greater breeze (½ in. downwards) production than 8%, saleable at only 20s. per ton, there is no economic justification for the

mechanical producer. In cases where breeze of ¾ in. downwards might command only this price it would become more economic, and if there is difficulty in gasifying run-of-retort coke in step grate producers owing to unsatisfactory labour conditions, it might be necessary to screen out the breeze resulting in a fuel charge of 75s. per ton and again the case for the mechanical producer would be improved.

The second appendix shows the annual saving on the cost of water supply for a 50,000 therms per day horizontal retort plant with producer gas dilution by the use of a cooling tower for turbine and coal gas condenser water. The estimate is based on water at 1s. 6d. per 1,000 gal. and electricity at 1d per unit. Total annual cost without cooling tower is £31,967, with it £5,361, an annual saving of £26,606.

Finally, Appendix III assesses the saving that can be made by 'home' electricity generation for an installation of continuous vertical retorts with a daily capacity of 30,000 therms. Two schemes are considered: (a) in which the works is operated as an 'all-steam' unit with steam raised from waste-heat at 120 lb. per sq. in. and 100°F. superheat; (b) in which steam is raised at a pressure of 250 lb. per sq. in. and 700°F. total temperature and fed to a pass-out turbo-alternator, all prime movers on the works being electric motors and process steam being met by pass-out from the turbine. In the 'all steam' scheme the annual cost of 140 mill. lb. steam at 1s. per 1,000 lb. amounts to £7,000, electricity with standing charge amounts to £4,000, a total of £11,000. In the pass-out turbine scheme 126.8 mill. lb. of steam accounts for £6,340, capital charges on £45,000 are put at £2,730 and the total with make-up water, labour, and maintenance adds up to £9,915 from which is deducted £6,410 for 3,850,000 kWh fed into the British Electricity Authority system at 0.4d. per unit, leaving a net cost of £3,505. It is noted that there is a saving of more than £1,000 per annum without this revenue, with the important additional advantage of an assured continuity of supply at all times.

DISCUSSION

Mr. R. L. Greaves (South Lancashire) said the subject was one with which most of them had been concerned for many years. He did not necessarily agree with everything the authors had said. His attitude would be to check and double check the statements contained in the paper and see if there was anything with which he did not agree. The authors appeared to have put the continuous vertical retort in the background; his own view for many reasons was that it should be in the forefront, though he realised there was a definite function for coke ovens and intermittent verticals. The authors appeared to believe that the best results were obtained with a calorific value of 500, but he did not know many retorts working at that figure. In a paper published in the *Journal* of December 12 D. J. Ward, of Birmingham, had spoken of a maximum possible make in volume and in therms at a calorific value of 480, and he suggested that in any upgrading of C.V. they might find 500 difficult to reach.

He agreed that the tendency was for costs to be about double pre-war figures, but in his experience vertical retorts had not yet reached that level. They had to do more dilution with blue water gas, but they were glad to have it brought to their notice that they could not just say that for any given calorific value they had to do this or that. The matter had to be gone into very carefully. He could not agree more about the question of the larger works being more economical.

Mr. Redman replied that the manufacture of 500 B.Th.U. gas had been carried on to a considerable degree in this country for a good many years. In certain circumstances it might be necessary to adopt special measures, such as the cooling of the bottom ironwork, but with Lancashire and Yorkshire coals there was no difficulty whatever in maintaining a C.V. of 500 or more. With regard to costs they should be careful to differentiate between net cost of gas and the cost of coal. Coal had doubled but cost of gas into holder had not quite doubled. Before reaching hasty decisions on the closing down of small works they should first find out the present cost of gas into holder and see whether, by spending a reasonable amount of money on automatic control, they could reduce that figure to the optimum figure given in the paper.

Mr. L. G. Townsend (Liverpool), speaking both on his own behalf and on behalf of Mr. W. S. Hubbard, who had had to leave the meeting early, said he presumed the authors were doing the obvious thing—namely, finding out what was really the most economic size and type of unit to install—and he thought they were to be congratulated on their efforts. The impression one got in reading the paper was that there were so many assumptions that one was left in some doubt as to how accurate the final conclusions might be. One table showed what should be obtained from the different plants based entirely on West's steaming curves. While that might be a convenient yardstick, in practice most of them knew that the results came considerably wide of the mark.

The shift rate had been shown in the paper at the schedule rates. It was worth noting that the actual cost of employing a man on any works was considerably greater when all the necessary overheads were taken into consideration. The yard price of coke had been taken in assessing the final cost, but surely the figure that mattered was the average price received, which could be considerably less. Where coke was being used internally, however, it was fairer to charge that coke at the cost at the receiving hopper to the particular plant concerned.

Labour Assessment

With regard to assessed labour he could assure the authors that they would find the utmost difficulty in operating a 75,000 therm works with a personnel of 102, excluding maintenance men. He would suggest that the figure, allowing for the maximum amount of modernisation, a 48-hour week, a six-shift week, fortnight's holiday, etc., would be considerably greater, but here again some qualification of mechanisation should be indicated. Further explanations on the reasons for items such as those mentioned would have been of considerable help in reading the paper. It should be pointed out that in connection with coke ovens they were not appreciably lower in fuel consumption than continuous vertical retorts, even without taking waste steam into account; nor were regenerators necessarily more efficient than recuperators.

The main category in which they at Liverpool were interested was the 30,000 therms per day unit which they had considered the optimum size for many years from the point of view of technical control. A table in the paper showed that the most economic calorific value of that unit for all types of carbonising plant under base load conditions was 500 B.Th.U. Under variable load the same applied at today's prices for coal and coke. It was more than a coincidence that, recovering 3½ gal. of benzole per ton, the C.V. of the gas to the plant at Liverpool was 480 B.Th.U. per cu.ft. It was surprising that no reference had been made to benzole recovery, since that would have a marked effect on the figures given. The inference from the paper was that since they had in general ceased to recover benzole they should re-declare their calorific values at a higher figure. What was the position when availability of plant permitted of full recovery of benzole once more?

A feature of the figures given was the conclusion that for the size of unit discussed here the horizontal retort produced the cheapest gas of 500 B.Th.U. when diluting with producer gas, and some explanation of that surprising conclusion would be of interest. The horizontal retort was no more exacting in choice of coal than the intermittent vertical chamber and would seem to hold the field. On the other hand one could not visualise such a unit being installed at the present time.

It was encouraging to note that provided they chose the recommended C.V. of 500 and employed the obvious diluent, producer gas, the cost of gas in the three systems was 7.4d. for horizontals, 7.66d. for intermittent verticals, and 7.67d. for continuous verticals per therm. In other words there was no significant difference in the cost of gas, and other factors must settle the outcome. Difficulties with purification, for example naphthalene, and local amenities might tend to discourage the choice of horizontals. The figures given were, in fact, only part of the story. Continuous verticals were frequently chosen to avoid the charging, discharging, and quenching nuisances associated with intermittent systems.

It was surprising that continuous verticals which produced the cheapest gas when capital charges were not taken into account were so seriously affected when they were included. The cheap cost of manufacture of continuous vertical gas was lost when capital charges were included. It was not generally appreciated that intermittent verticals had such great advan-

(*Continued on p. 247*)

tages in respect of capital cost, and some figures relating to those capital costs per mill. cu.ft. of gas per day would be welcome. Experience at Liverpool indicated advantages from mechanical producers with vertical retorts if one considered the possibility of greater breeze production with weakly caking coals. The advantages of mechanical plants had been dealt with on a previous occasion. The provision of a standby plant at £20,000 was, in their experience, unnecessary.

Mr. Redman said the figures given in the paper represented good average results from new plant. With regard to shift rates he was aware that they had been increased again since the paper was prepared. They had taken reliefs into account, but not holidays, and perhaps the labour figure was slightly low for that reason. The yard price of coke was the price they expected to get for it, and he thought 75s. per ton was a reasonable price for coke ex works.

They had not dealt with benzole recovery. The situation was that it was just about economical to recover benzole on the bigger unit. It meant, however, an increased coal consumption, but no doubt in the future, unless coal rose precipitously they would start benzole recovery on a large scale. At present it would be rather a waste of time because they were not in a position, nationally, to produce benzole to any appreciable extent.

Thermal Output

Mr. A. K. Collinge (Preston) referred to a paper by Barash and Tomlinson (and he expressed pleasure at seeing Mr. Tomlinson present at that meeting) which showed that therms per retort only fell by just over 1% as a result of varying the C.V. from 500 to 475. Mr. Nicklin had referred to the cost of raising steam, but he had not mentioned the advantages of internal quenching—a method which he (Mr. Collinge) introduced at the Preston works 20 years ago. On the question of the cost of water supply he suggested that it would be a very inept engineer who would design a 50,000 therms per day horizontal retort plant involving an expenditure of nearly £32,000 a year for water. On the vertical plant at Preston, 30,000 therms per day, the whole of the water cost £3,000 (at 1s. 6d. per 1,000 gal.) so that for a 50,000 therms plant the cost should be about £5,000.

Mr. Redman replied that thermal output was much reduced when making gas of 450 B.Th.U., and he suggested that 500 would still be an economic calorific value if they had water quenching, because practically all the steam was absorbed for process work on the works. The fact that they would be reducing steam consumption very slightly would not mean any alteration in the economic C.V. It would be possible to effect some economy by generating steam from the waste heat. Until a perfect recirculation system had been devised for any particular works it would not be possible to say whether the water consumption cost figure was the best that could be obtained.

Mr. J. H. Dyde (President of the Institution of Gas Engineers) said there was a great deal of careful thought and intelligence and hard work behind the paper. He regarded it as a monumental work, and as it was a monument one had to stand back and look at its essential features. The authors had employed a system of mathematical application and method in which very many assumptions necessarily had to be made. One could naturally criticise the basis of some of these assumptions; depreciation, for instance, was not uniform for all types of plant, but the authors had taken an average of 25 years. Repairs and maintenance, which included labour, were put at 7d. per 1,000 cu.ft. on the smallest works, the figure going down progressively on the larger works until, at 5 mill. per day, the figure was halved.

These figures were taken regardless of the type of plant or the manner of its operation. Included in the figure for repairs and maintenance was, of course, the very big item of resetting. Supporting figures representing the equalised cost of gas retort resetting, covering minor and major reconstruction, would have a significant bearing on the repairs and maintenance costs which should be allowed each year. Taking production units *per se* by themselves, and assuming them to be operated efficiently as he thought most of them were, and allowing a standard price for coal into the retorts and for coke sold, he suggested that the difference between production costs in one works and those in another was to be found in the way in which steam and power were generated and used.

Apart from the theoretical selection of plant on the basis of costs, there were other overriding considerations. There was the question of amentity and planning regulations. He had been looking all over the Eastern area for a site for a coke oven plant, and it was difficult enough to find a site for intermittent vertical chambers. That was a physical factor that was overriding. Reference had been made to coal gas/water gas ratios and the possible effect in the future of resetting not only during the summer months but throughout the whole year. Such a necessity might be a very significant factor in determining the ratios of water gas and coal gas.

In the North Western area they had had particular experience with refinery gases, and he was interested to know that they had selected dilution by producer gas as the best way of dealing with it. On the subject of petroleum/air mixtures it was well known that there were many small works where there was no hope of getting link mains, and there appeared to be a chance of maintaining gas supplies economically and competitively by the use of butane/air mixtures. The Eastern Board had two plants on order, and the Wales Board would shortly have two plants at work.

Mr. Nicklin said the economics of refinery gas utilisation were based entirely on the comparison between the cost of the carbon therm in the refinery gas and the cost of the carbon therm in coke.

Mr Redman said the object of the paper was to show that the best method of providing the most economical gas was by diluting with producer gas, and to provide a yardstick to measure the efficiency of works operations. They had set out to establish whether there was an economic size of unit, and what was the economic calorific value. With regard to depreciation, this had been discussed with the accountancy people, and they had decided that within the limits of accuracy required they were justified in taking an average of 25 years. Retort resetting was definitely included in the figures for repairs and maintenance, and the figures were such as were being obtained in practice at present in the North Western area.

A vote of thanks was accorded to the authors on the proposition of **Mr. A. McDonald,** Senior Vice-Chairman, seconded by **Mr. A. K. Collinge,** Junior Vice-Chairman.

STREET LIGHTING CODE OF PRACTICE

OF interest to lighting engineers and local authorities will be the issue of the British Standard Code of Practice for Street Lighting. Part 1: Traffic Routes (CP. 1004:1951), which belongs to the series of engineering codes issued jointly by the Institution of Electrical Engineers and British Standards Institution. The code is designed to develop the recommendations made in the final report of the Ministry of Transport Departmental committee on Street Lighting (H.M.S.O. 1937) and this part deals with traffic routes only—*i.e.*, roads classed in the report as Group A. A further part of the code is in preparation to deal with the design of lighting for other routes.

The code explains the allowances that should be made, when the lighting of a given road is planned, for prevailing conditions—*e.g.*, volume and type of traffic, layout and nature of the road and its surface, boundary conditions, etc., in order that the required level of lighting expressed in lumens per linear foot of route may be secured.

Recommendations are made, for various circumstances, on the choice of light distribution (cut-off fittings or non-cut-off fittings), and on the spacing of lanterns. The use of either electricity or gas is envisaged, but electrical and gas installation practice is outside the scope. Particular attention is given to considerations governing the placing of lanterns, and advice is included on methods of marking out a site. Recommendations are made for maintaining the performance of installations.

Appendices set out the information which should be supplied by enquirers (when tenders are invited) and with tenders. The text is illustrated by numerous drawings, including diagrams of typical sites.

Copies of the code may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W. 1, price 4s. post free.